# Electrical World

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**Wiring Guaranteed by Contractors**

The proposal of the Electrical Contractors' Association of Great Britain to guarantee the work of its members might well be emulated to advantage by the National Electrical Contractors' Association of this country. Although the scheme has not been worked out to its finality, yet even in its embryonic stage it possesses features of merit. Briefly stated, every member of the association undertakes to carry out interior wiring contracts in strict conformity with the rules in force; the association stands back of this guarantee by agreeing to indemnify the employer of any of its members against bad workmanship or materials, and any member failing to remedy defective work after being notified by the association to do so will be dropped from the organization. Such a scheme, if adopted by the 1200 members of the National Electrical Contractors' Association, would do more to raise the general standards of wiring in this country than anything of which we can conceive, and surely the industry will benefit by the change. Putting aside entirely the question of the rights of the householder or owner to good work, which every reputable contractor will grant, the opportunity ought to be embraced by contractors if for no other motives than those which are of selfish origin.

**American Society of Engineering**

A salient characteristic of the professions of medicine and engineering is their diversification. Law practice also is diversified, so that practitioners in one branch rarely extend their efforts into other branches. Nevertheless, the training of students in the law schools is ordinarily the same, whatever branch they may intend to follow or chance to become associated with. In the medical schools, until within recent years, the training of students was the same, and differentiation likewise became effective only in practice. Now, however, the range of medical study is becoming so large, in so many different departments, that differentiation is becoming necessary in the school curriculum. In engineering this differentiation is very marked. It has long been realized as impossible to train an engineering student, as was Moses according to the biblical text, "in all the knowledge of the Egyptians." A division of engineering school curricula into four branches—civil, mechanical, electrical and mining—has been customary. So fast, however, do new specialties in engineering arise and so hopeless is the task of training fully for each, or of knowing beforehand which branch the student will ultimately adopt, that the modern tendency is rather toward unification than further differentiation in the schools, with the purpose of teaching the fundamental principles thoroughly, in mathematics, mechanics, physics and chemisty, leaving the specialization to subsequent effort in practical life or for post-graduate study. Dr. William McClellan made a similar suggestion to the engineering profession, in a paper presented at the Cooperstown convention of the A. I. E. E. He pointed out very forcibly the loss of momentum which accompanies the segregation of engineers into separate societies, each devoted to a specialty. He desires to see a unification effected, whereby the social and intellectual momentum of the whole engineering body may be conserved and made effective. Although few will question the desirability of the objects Dr. McClellan wishes to accomplish, there may be some who will not agree with certain of the details of the method proposed by him for unifying the engineering societies in activities of a professional nature, and doubt may be expressed as to the timeliness of his suggestion. There may indeed be some objection to creating a new society when there are evidently too many now in existence. However, since membership in the new association is to be restricted to representatives from existing societies, there being no members as individuals, the increase in the number of societies is not likely to prove highly objectionable. Concerning the timeliness of the suggestion, it would seem that now, rather perhaps than at any time within the next five years, is the preferable moment for bringing forward the idea of concerted effort by the engineering societies to place the engineering profession on a high plane, in view of the forthcoming conventions of engineering societies in San Francisco during 1915. Now, as never before, the advantages of co-operation along purely professional engineering lines are being increasingly appreciated. The good seed should be sown now while the ground is in condition to bring forth abundantly.

**The Watt Versus the Horse-Power**

In its recent report the N. E. L. A. committee on measurements entered a plea for the more general use of the watt, and the more limited use of the horse-power, when specifying the power of boilers, turbines, engines, machinery or apparatus. Instead of keeping a single unit, the watt, for use in dealing with power, our technical literature swarms with half a dozen other units, all more or less unsatisfactory and brain-wearying. In view of the fact that there is no logical relation between the so-called "boiler-horse-power" and the horse-power developed by an engine receiving steam from the boiler, the desirability of abolishing the term "boiler-horse-power" has long been appreciated. The recent happy suggestion to substitute a proper multiple of the watt for the boiler-horse-power, which, as usually defined, is approximately equal

to ten kilowatts, has been enthusiastically indorsed by many engineers and opposed by many whom one would expect to welcome the improvement. It is indeed strange that, although the watt is primarily a mechanical unit of power and only secondarily an electrical unit, and also is named after a great mechanical engineer—James Watt—many mechanical engineers object to its use because to them it seems to be an electrical unit.

## The Institute Convention

The Cooperstown convention of the American Institute of Electrical Engineers was an important occasion from several points of view. It was well planned and successfully carried out. The meeting place was happily chosen, and combined with the excellent balance between the technical and the social programs there was a diversity of interests sufficient to satisfy in some degree the tastes of all, which is perhaps as much as one can expect of these events in general. In pleasing contrast with last year's crowded program of some sixty-five papers, with an allowance of only fourteen working hours for their consideration, there were only twenty-six papers here presented, with a working period of about seventeen hours. Printed copies of the papers were distributed well in advance, and as a whole there was plenty of time for discussion. Owing, however, to an unequal allotment of time for the papers on the program, some of them received rather scant consideration—a defect which can obviously be overcome by setting aside a fixed period for each paper and its discussion, and by prearrangement calling upon certain individuals to open the discussion from notes prepared in advance. In point of attendance the total registration of 239 certainly compares well with 178 at Jefferson, N. H., and 252 at Frontenac, N. Y., although the Atlantic City meeting, naturally enough, eclipsed them all. The large attendance secured at Boston and Chicago was, of course, drawn to a great extent from the local regions.

As a barometer indicating the trend of mind of many leaders in the profession, the remarks of both the president and the president-elect on the position which the electrical engineer, and all engineers for that matter, ought to occupy in relation to the affairs of industry, commerce and government are timely and important. A concrete suggestion toward the realization of this end was contributed in the paper by Dr. McClellan, and the hearty indorsement which it received shows clearly that the electrical profession will back the movement. A number of the papers presented will easily rank as classics, and others, while perhaps not in the same class, provoked such discussion as to indicate their present significance.

Notable among the high lights of the convention was the earnest attention given to the fundamental matter of framing a correct economic basis for the discussion and comparison of energy costs, and the evident determination shown to delve deeper into the mysteries of that evasive but important agent of the transmission engineer, the porcelain insulator. Considerable appreciation was expressed also of the somewhat unexpected interest displayed in the session held under the auspices of the electrophysics committee, which bespeaks an increasingly close relation between the physicist and the engineer.

As a closing commentary upon the Cooperstown convention it may not be amiss to point out that there are increasing signs of a general realization that these events serve a valuable purpose in bringing engineers together. It is one thing to know a subject profoundly, it is quite another to be able to discuss it forcefully before a gathering of one's contemporaries, sprinkled with men whose reputation is country-wide or even international. The engineer who would be broad, and who would enlarge his culture by contact with men of superior attainments, must obviously mingle with his fellow-kind at such gatherings as these. They hold the greatest potential advantage of all for the younger men, who may improve themselves by mutual fellowship and take away the inspiration which comes from meeting and listening to the leaders of the profession.

## The Computation of Energy Costs

The A. I. E. E. paper on the standardization of cost estimates by Messrs. H. G. Stott and W. S. Gorsuch represents what is emphatically a movement in the right direction. In the past it has been extremely difficult to find out, even from figures conscientiously made and presented in an honest effort to show the facts, just what real cost of energy must be reckoned with. Certain items in the cost of energy, such as the coal supply and the wages of the actual operating staff, are easily ascertained, but there has been no definite plan of action in charging against the cost of the energy produced the great group of somewhat indefinite items which hang undecided between power-house expense and the general expense, between repairs and renewals, between operating costs and fixed charges. For a long time it was a habit of plant managers to compare and promulgate costs on the basis of coal plus oil, waste and water plus power-house labor, with the result of obtaining beautifully low figures of a character to tempt public service commissions into pernicious activity. Anyone who looks over the carefully prepared list of items presented by Messrs. Stott and Gorsuch will come to a realizing sense that many more than the items just mentioned go into the actual costs of producing energy in a plant built and operated as a permanent investment. The authors explain and analyze just the meaning of the schedule and the items which should go into each group.

Perhaps the most illuminating portion of the paper is the consideration of the investment cost and the general charges appertaining to it. Carefully as the matter is studied out, some items of this kind are a bit puzzling. The division, for example, of franchise tax and casualty insurance between production and distribution is not altogether obvious even with the help of the explanations as regards general methods. The most ingenious feature of this particular account is the treatment of the amortization fund, which is intended to take care of depreciation involving renewals by the establishment of an actual sinking fund, unhappily far too rare in power-station accounts. The most important item of the expense that is to be

taken care of is what the authors call "functional depreciation," which is practically the thing frequently referred to as depreciation due to change in the art. Obsolescence and inadequacy are the usual causes for scrapping power-station equipment, and they are good and valid causes. One happy suggestion of the authors in this connection is that the lack of knowledge of the real amount of such depreciation makes it necessary to adjust periodically the rate of accumulation of the amortization fund so as to take account of experience in the life of apparatus and general equipment. It is fortunately true that much recent apparatus stands upon an entirely different plane with respect to endurance from the apparatus of earlier years. The physical depreciation, for example, of a big generator is very small indeed, and the functional depreciation, while considerably larger than the physical, tends to be much less than would have been indicated by the estimates of ten years ago. Hence the need of readjusting one's estimates of probable useful life in view of experience. If power-station operations would follow consistently the plan proposed by Messrs. Stott and Gorsuch, the actual practical costs of energy production would soon become much better known than at present. They would not seem quite so low as the loose experience of earlier practice would suggest, but the figures would be far more valuable as a guide to the central-station manager.

## Tungsten Lamps for Street Lighting

A recent issue of the *Electrotechnische Zeitschrift* contained data on the very interesting changes which the street lighting of the city of Dresden has undergone within the past few years. In Dresden, as in many other Continental cities, use is made of both gas and electricity for lighting, but the chief streets of late years have been lighted with electric arc lamps and some of the secondary streets with incandescent lamps. Ten years ago the important streets were illuminated with the ordinary carbon arc lamp, familiar at the time in most European cities. These lamps were run with fairly large currents and used high-grade carbon electrodes such as are common in Continental lighting. The arc lamps thus operated were much better than the contemporaneous American inclosed arc lamps, having a considerably higher efficiency, equally good steadiness and producing a beautiful white light very different from the bluish light of the inclosed arc lamp. A few years later the flaming-arc lamp made its appearance and the metallic-filament lamp also came into use. Five years ago the carbon arc lamp was being rapidly replaced by the yellow-flame arc lamp, and most of the carbon incandescent lamps had been replaced by tungsten lamps. Another year saw the complete replacement of both the older illuminants and the beginning of the use of tungsten lamps, no lamp in the first installation having a rating larger than 50 cp. This was a change sufficiently startling for a few years and admirable in its results.

Developments more recently have been somewhat revolutionary. Within the past two or three years the large tungsten lamps have come into considerable use and have been rapidly replacing the flaming-arc lamps. The lamps used are rated at 400, 600 and 1000 cp, the lamps being fitted with reflectors, and in some cases with inclosing globes as well, and hung at the height of 7 m instead of 8 m, which had been standard for the arc lamps. In the chief streets they are mounted on cross-suspensions, by far the most advantageous position for service. The reduction in cost of service by the substitution of the metallic-filament lamps has been very considerable. The Dresden flaming-arc lamps were of the alternating-current variety working at 8 amp, and consequently by no means at the top efficiency for the flaming type of lamp. Whether a similar change would have worked out as advantageously against direct-current flame lamps at a somewhat higher current may be regarded as dubious, since for the same illumination a considerable increase in the number of metallic-filament lamps would have been necessary. Nevertheless, the Dresden experience hints very strongly that the less powerful arc lamps, even modern flame lamps, can be very hard pushed by the large tungsten lamps now available and are extremely likely to be superseded.

## The Illinois Public Utility Law

During the present week Governor Dunne of Illinois signed the new public utility bill recently passed by the Legislature. The measure, an abstract of which appeared in our issue dated June 28, goes into effect on Jan. 1, 1914. In all important respects save one this seems to be an excellent law, but the provision exempting municipally owned utilities from jurisdiction is a serious defect. The discrimination against privately owned companies would seem to be the work of municipal-ownership enthusiasts who wish to ride their hobby unrestrained. This view of the matter is supported by the circumstance that the Legislature passed another bill authorizing cities to acquire, construct, own, lease or operate public utilities. Perhaps the quoted remarks of the Governor cover the situation as frankly as any: "With such rights given to cities, private corporations now furnishing gas, electric light, heat, power and other utilities will be compelled to give decent service at decent rates or face the alternative of public ownership." But is municipal ownership and operation without regulation the desirable alternative? We think not, nor can we discern any adequate defense of the injustice and discrimination of forcing private companies to submit both to regulation for themselves and unregulated municipal competition at one and the same time. All the arguments against the "home-rule" feature which became such a bone of contention in framing the law in the Legislature are equally potent against unregulated municipal ownership and operation. Experience elsewhere, in Wisconsin for example, establishes very clearly that municipally managed utilities as a whole are quite as much in need of regulation as are the private companies, if not more so. This defect in the Illinois law is merely the outcome of another scrimmage in the endless contest between selfish interests and the public welfare, this time with the leaders of the people in the wrong. The just course is both clear and simple, but it seems the pendulum has swung too far and a measure of patience is needed to await the return to equilibrium.

# The News of the Week

**Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.**

## Norwegian-American Radio-Telegraphy

Mention was made on page 1406 of our issue dated June 28 of the preliminary arrangements for a contract between the Marconi Wireless Telegraph Company and the Norwegian government for wireless service between Norway and America. The Norwegian Storthing has ratified a twenty-five-year contract for the joint operation of stations at Stavanger and in New England. Two locations, 20 miles apart, will be chosen at once somewhere in Massachusetts or Connecticut, and the Marconi Wireless Telegraph Company of America will build separate receiving and transmitting stations similar to those now being constructed at New Brunswick and Belmar, in New Jersey. They will form part of the world-encircling chain of stations, which includes San Francisco, Honolulu, Yokohama, Bangalore and Alexandria.

## Experts Selected for Chicago Terminal Plans

Dean W. F. M. Goss, of the University of Illinois, Urbana, has been appointed chief engineer to the committee on smoke abatement of the Chicago Association of Commerce, succeeding the late Horace G. Burt, of Chicago, whose death was recently announced in these columns. The university has agreed to grant Professor Goss a year's furlough from collegiate duties in order that he may carry on his work in Chicago. Dean Goss, who is at present touring Europe with the American Society of Mechanical Engineers, is one of the best-known railroad engineers of the country and before his appointment at Illinois was dean of the engineering schools of Purdue University, Lafayette, Ind.

The railway terminal committee of the Chicago City Council has also appointed Mr. John F. Wallace expert adviser to the committee in the formulation of its plan for terminal facilities for the steam railroads entering Chicago from the south. Mr. Wallace is to submit a report in ninety days. The terminal committee's new appointee is president of the Westinghouse, Church & Kerr Company, consulting and constructing engineers, New York, and was formerly chief engineer of the Panama Canal work.

## Outages on Ontario System; Toronto Company to Rescue

Several serious outages have recently annoyed customers of the Ontario Hydro-Electric Commission's system, which is generally recognized as one of the best constructed transmission systems ever built. From 10 a. m. to 5:10 p. m. on June 16 service was off over the commission's Toronto system and in a large part of the Province and this would have caused serious inconvenience locally had not the Toronto Electric Company, which is a competitor of the municipal system, generously furnished 12,000-volt emergency service over an improvised connection from its terminal substation. Fortunately the break was repaired before dark, but the Toronto company offered to carry the city street lighting that evening if necessary. Credit is also deserved by the Toronto company for the rapid connection made, service having been available within one hour after Works Commissioner Harris applied for assistance.

To avert possibility of a water famine, the Toronto electrically driven water-works pumps were also transferred to the local central station company's system and thus continued operation uninterrupted.

On July 2 there occurred another interruption to the Hydro-Electric Commission's service at Toronto, the third serious one within three weeks. This time the "power" went off at 3 a. m. Wednesday and was not resumed again until 10 a. m. the same day. In view of the prevalence of transmission troubles during the last few weeks it has been suggested locally that some permanent basis for energy interchange be agreed upon between the two public-service organizations.

The merchants and manufacturers at London, Ont., who are customers of the provincial Hydro-Electric system, are also complaining of the poor service they have been receiving lately. From June 1 to June 26, inclusive, there were thirteen interruptions, totaling twenty-eight hours. The most recent trouble occurred on June 25, when the Hydro service was off for fifty-five minutes. The thirteen interruptions mentioned include two in which the whole 297 miles of Hydro lines in Ontario were out of commission, once for seven hours. The other outages were of local origin.

## Pennsylvania Utility Law

The public utilities bill in the State of Pennsylvania, mentioned on page 1204 of our issue for June 7, 1913, having been passed by both the House and Senate, is now before the Governor for his signature. The bill is believed to be in a form to protect the State, the municipalities, the consumers and the private utility companies.

## Illinois Utilities Law Signed by the Governor

Notwithstanding the vigorous opposition of the city administration of Chicago, which was insistent upon "home rule," Governor Dunne on June 30 signed the bill recently passed by the Legislature of Illinois creating a public utilities commission for that State. A summary of the new law was given in the *Electrical World* of June 28.

To explain his approval of the bill the Governor issued a public statement. He says that regulation by commission should have a reasonable trial in Illinois. If it fails, there is the alternative of public ownership under the "splendid public-ownership measure" recently passed by the Legislature and signed by the Governor. This is the Waage law authorizing cites to acquire, lease and operate public utilities and to sell the service to private consumers. The Governor says that the new Illinois utilities-commission law is better than the Wisconsin law, as it eliminates commission control of municipally owned utilities and does not give private corporations indeterminate franchises. Regret is expressed that the home-rule article was stricken from the bill, and the Governor says that this feature can be put in it at a future session of the Legislature. The executive promises to appoint as members of the state commission

"men of such character and ability as to place the cities of the State under no political disadvantage by reason of the failure to include the 'home-rule' amendment." The Governor also makes this statement: "Public ownership, in my judgment, must be the ultimate solution of the complex problems which forever are arising from the attempts of the people to exercise legitimate and lawful control over public-utility corporations, but realization of the benefits of public ownership may be deferred for a long time. Hence it is urgently essential that there shall be centralized control and authority now."

Mayor Harrison of Chicago and a large proportion of the City Council waited on the Governor in Springfield on June 25. They urged him by all arguments at their command to veto the bill and give "home rule" to Chicago. Included in the delegation were representatives of the city and county government in Chicago, the Municipal Voters' League and the Chicago Federation of Labor; also the United Societies for Local Self-Government and various civic organizations. The Mayor and a number of aldermen and others made speeches urging the Governor to veto the bill.

On June 24 the question was discussed before the City Club of Chicago at a meeting over which Mr. George C. Sikes presided. The first speaker was State Senator Dailey, of Peoria, who favors the bill as passed. Mr. Edward W. Bemis, of Chicago, public utility expert, opposed the bill as passed. One point he made was that one commission could not handle all the utilities of Chicago and the rest of Illinois, including the railroads. State Senator Walter Clyde Jones and Mr. James G. Skinner, assistant corporation counsel of Chicago, also spoke against the bill as passed. Mr. Skinner helped to draft the original bill, with the "home-rule" article in it.

Public sentiment has been expressed for as well as against the bill. The Illinois Mayors' Association, by a vote of fourteen to ten, defeated a resolution requesting the Governor to veto the bill. Representative Rapp, of Fairfield, who introduced the bill in the House with the original "home rule" feature, came out with a statement favoring the bill, even though amended.

## Refusal to Purchase Boston Municipal Gas-Lighting Equipment Sustained

The full bench of the Supreme Court of Massachusetts has sustained Commissioner of Public Works Louis K. Rourke, of Boston, in his refusal to expend $300,000 appropriated in May, 1911, by the City Council for some 11,000 gas lamps and fixtures for street lighting on a municipal ownership basis. On June 14 Commissioner Rourke signed a contract with the Boston Consolidated Gas Company for this lighting at a rate of $21.50 a lamp a year, on a ten-year basis, but before the agreement can become active it must be approved by each branch of the city government and the Mayor. For over a year past Commissioner Rourke has favored accepting the offers of the Boston Edison company at $18.33 per 60-watt tungsten lamp and $21.14 per 80-watt lamp annually. These offers mean a saving of from $27,000 to $60,000 a year compared with the Rising Sun contract. The court points out in its decision that under the circumstances the city ought not to be compelled to expend this large amount of money for a purpose which, according to the commissioner's belief, apparently supported by substantial reasons, would be unwise, and says: "There is no such compulsion to be found in the city charter of Boston or in the general laws of the commonwealth. The appropriation of money for a specific purpose by the legislative department of the city of Boston does not make its expenditure mandatory on the executive officers in a case like the present."

## Pittsburgh I. E. S. Convention

The Hotel Schenley has been selected as headquarters for the Illuminating Engineering Society convention, which will be held in Pittsburgh, Sept. 22 to 26. The choice is peculiarly fitting as the hotel is near the Carnegie Museum and Library, Carnegie Technical Schools, University of Pittsburgh, several prominent clubs and the Soldiers' Memorial Hall, the lighting effects of which are unique in this country. Among the entertainment features of the convention will be the annual banquet, golf, tennis, baseball games, automobile rides, theater and card parties, and inspection trips to local industrial plants. Subjects of convention papers already scheduled are the quartz and neon-tube lamps; church, factory, store, hospital and street-car lighting; the present commercial development in several forms of lighting; errors in photometric measurement, and the history of artificial lighting. Symposiums will also be held on various general subjects. A transportation committee, which includes the secretary in each city having a local section, will make arrangements for members and friends in obtaining transportation to and from Pittsburgh.

## How the Illinois Legislature Passed the Bill for a Utilities Commission

In the closing hours of the Forty-eighth General Assembly—to be exact, at 1:15 a.m. on June 21—the Illinois Legislature took the final steps to pass a bill creating a state public utilities commission. The bill provides for a single state-wide commission controlling all public utilities, abolishing the present Railroad and Warehouse Commission, and without the home-rule proviso so strenuously demanded by the city administration of Chicago.

The history of the agitation for a public-service commission or commissions in Illinois during recent years makes an interesting story. The Legislature of the State meets biennially, and public-utility-commission bills of varied purport have been introduced at preceding sessions. Two years ago the whole subject was referred to a joint legislative commission directed to report to the Legislature of 1913. The Republicans were in control of this commission, of which Senator Dailey, of Peoria, was chairman. This committee visited Wisconsin, Massachusetts, New York and other states and held a number of hearings in Illinois. It prepared an elaborate report, with draft of bill attached, modeled to some extent on the Wisconsin law.

But in the meantime the 1912 elections had taken place. A Democratic state administration was elected, and Senator Dailey escaped defeat for re-election by a narrow margin. Mr. Edward F. Dunne, of Chicago, was elected Governor. He is a man of the highest character and of conceded ability, but rather "advanced" in advocating municipal ownership and distrusting utility corporations, as he demonstrated when Mayor of Chicago. A remarkable Legislature was elected at the same time. In neither house has any political party a majority. Both houses are presided over by bright, ambitious young Democrats about thirty-one years of age, who had never before served in the Legislature or had legislative experience.

The Governor had made a state utility commission one feature of his platform. He wanted the Legislature to pass a bill on lines which he favored, giving "home rule" to the cities of the State; that is, giving direct control of local utilities to cities of 20,000 and over and permitting smaller cities to vote themselves under or out of control of the state commission. He had a bill drawn to express his ideas by members of the faculty of the University of Illinois in conjunction with lawyers from the office of the corporation counsel of Chicago. This bill was introduced by Representative Rapp, of Fairfield, and is the bill, materially amended, which finally passed. The Dailey bill and

several others never had a chance, although, as adopted, the Rapp bill is similar in broad general features to the Dailey bill.

Article VI in the original Rapp bill gave cities the power to regulate their own utilities and to fix rates. It was the great bone of contention. The bill was referred to a committee in the House, reported back with minor changes, but when it came up for debate this section was stricken out by a close vote, and the bill was then passed by the House. Then the city administration of Chicago became alarmed. Mayor Harrison, Corporation Counsel Sexton and forty aldermen, including Alderman Merriam, hurried down to Springfield to labor with the Senate. A public hearing was held at which Mayor Harrison made an earnest plea that Chicago be let alone in the management of its utilities. Governor Dunne also spoke, expressing his love for home rule, but rather intimating that if he couldn't get all he wanted he would take what he could get, provided a fairly satisfactory state commission was created.

The fight was now on in earnest. In the Senate the bill was not referred to a committee but was discussed on the floor. Senator Glackin, of Chicago, a Democrat close to the city administration, led the home-rule forces. Senator Dailey, of Peoria, a Republican, championed the single state-wide commission. On June 18, in the closing days (adjournment being fixed for June 20), there was a great debate on the bill in the Senate on second reading. Amendments were introduced reinstating Article VI and also eliminating the power of the state commission to control the issue of stocks and bonds by public-utility companies. Senator Dailey made an impassioned plea for the abandonment of Article VI. Senator Walter Clyde Jones, of Chicago, leader of the Progressives, cast his lot with the home rulers. By a vote of thirty-one to sixteen the amendments were adopted by the Senate. Party lines were not strictly observed, but in general the Democrats and Progressives voted for the Senate amendments. Victory for home rule!

On June 20, the closing day, the amended bill came up for third reading and passage in the Senate. Senator Dailey said that the bill as amended by the Senate was a monstrosity. Senator Manny, of Mount Sterling, Democratic floor leader, expressed himself as favoring one state-wide commission; still, he held, some kind of a commission is better than none, and he voted for the bill with Article VI reinstated, but with reluctance. On roll call the bill passed the Senate as amended in that body by a vote of thirty-two to seven. Senate firm as a rock—almost—for home rule!

Now back to the House. About 9:30 p.m. on June 20 the House took up the bill with Senate amendments. Mr. Rapp explained the amendments and moved that the House concur in them. More oratory. Representative Holaday, of Danville, said that the home-rule commission as offered by the Senate would be a farce. The renowned Lee O'Neil Browne, of Ottawa, scored the Senate amendments severely. Many other representatives explained their votes on roll-call. At 11:30 the result of the voting is announced. The "ayes," favoring concurrence, are seventy, the nays forty-three. But, alas for home rule! Seventy-seven votes, or a majority of all representatives elected, are needed to adopt the motion, and thus the House does not concur in the Senate amendments.

What next? Returning to the Senate, we shall see. It is now 12:30 a.m. on June 21, but still the legislative day of June 20, it appears. The Senate is debating whether it shall recede from its amendments. Dailey moves to recede. Home rule is limping badly, and Glackin is visibly anxious. More impassioned speech-making. Then announcement of the vote at 1:15 a.m. By a tally of twenty-seven to twenty the Senate has voted to recede from its amendments. Thus the Rapp bill as amended by the House has passed both houses in the same form, and municipal regulation of public utilities—the home-rule argument—is a dead issue in the Forty-eighth General Assembly of the State of Illinois. What brought about the change in the Senate? Undoubtedly the action of the friends of the Governor. Several measures favored by the state administration, as initiative and referendum, a state tax commission and others, failed to pass, and at the last moment it was apparently decided to save something from the wreck in the shape of a state public-utility commission, not indeed with the desired home-rule features, but still a state commission, to which the Governor was pledged.

Senators Glackin and Keller, of Ava, filed a formal protest against the passage of the motion to recede at 1:15 a.m. on the day after the day set for adjournment by previous resolution. The protest was received as a constitutional right, but the Lieutenant-Governor remarked that it has been repeatedly held by the courts in Illinois that in the case of a continuous night session the legislative "day" does not expire until 10 o'clock in the morning of the next calendar day.

At its meeting of June 23 the Chicago City Council adopted resolutions requesting Governor Dunne to veto the bill, which was declared to be a "vicious measure subversive of the rights of the people of Chicago and other municipalities." A telegram signed by the Mayor and sixty-seven of the seventy aldermen was sent to the Governor, requesting a hearing and urging him to veto the bill in the interest of "home rule."

A synopsis of the bill as passed by the Legislature was given on page 1401 of our issue dated June 28. As noted elsewhere in the present issue, Governor Dunne signed the bill on June 30.

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## Contention Over Depreciation Fund in Attack on Cincinnati-Union Lease

A contest which threatens the legal existence of the Union Gas & Electric Company, of Cincinnati, as well as the life of the lease under which the Cincinnati utility property is operated by the lessee company, is now being waged to determine whether the underlying Cincinnati Gas & Electric Company or its tenant shall make the outlay for the new four-million-dollar power plant, which is badly needed for the local service. The underlying company, through a protective committee of its stockholders, claims that this new plant is a replacement of the existing Plum Street station, and that since by the terms of the lease the tenant company is required to maintain the property against depreciation, the Union company should build the new plant itself. The tenant company insists, however, that the proposed station represents simply a plant extension, and that therefore its cost should be defrayed, as in the case of recent additions to the Plum Street equipment, by the underlying concern.

The Cincinnati Gas & Electric Company, which is the owner of the central-station and gas properties in Cincinnati, now has outstanding $35,000,000 of 5 per cent securities out of an authorized issue of $36,000,000. Its property was leased for a term of ninety-nine years (beginning with 1906) to the Union Gas & Electric Company. Of this latter company's authorized allowance of $10,000,000 of 6 per cent stock, $5,000,000 has been issued, together with $10,000,000 of common stock. The Union company in turn is controlled by the Columbia Gas & Electric Company, a holding corporation which also controls the gas, electric-lighting and railway properties just across the Ohio River in Covington and Newport, Ky. The Columbia Gas & Electric Company has a capital stock of $50,000,000, and $13,000,000 outstanding in bonds out of a total of $20,000,000 authorized. It now plans to issue further $3,000,000 worth of 5 per cent debentures to acquire that

balance of the Union company's stock which it has not heretofore owned. The Columbia company's control of the Union company is at the present time effected, however, through the ownership of 60 per cent of the latter's preferred stock and 50 per cent of its common stock.

At the present time the principal generating plant of the Cincinnati property is the old Plum Street station, which contains about 30,000 kw in reciprocating and turbine units. Besides being inadequate, this plant will shortly be rendered useless by the draining of the canal from which it receives its condenser circulating supply, as the canal bed is to be converted into a city boulevard. It has therefore become imperative that a modern 50,000-kw turbine station be erected on the river front at a central point from which the surrounding community can be served.

From $3,000,000 to $4,000,000 will be needed for this new station, and it is the necessity for this additional capital investment which has precipitated the present contest. In this the initiative is being taken by a stockholders' protective committee of Cincinnati Gas & Electric Company shareholders. Mr. J. Evans Lippincott is chairman of the committee, the other members of which are Messrs. Jesse Lowman, Frederick A. Hilker and George W. Pohlman, Jr., secretary. Mr. Samuel Assur has been retained as counsel. The stock of the Cincinnati company is held by about 8000 shareholders, the average amount in each case being about forty shares. Nearly 7500 of the stockholders live in the vicinity of Cincinnati.

The stockholders' protective committee contends that the building of a new plant is an expense that should be paid entirely by the Union Gas & Electric Company by reason of the fact that it is a replacement of an inadequate and obsolete electric-light plant. The Union company, it is pointed out, may obtain payment from the Cincinnati Gas & Electric Company only for extensions and new additions which are agreed to by the latter underlying company, and which, under the lease, must be paid for by the Union Gas & Electric Company in the first instance, while the Cincinnati Gas & Electric Company may elect to pay for such new additions at the termination of the lease at the then value of such additions or improvements. In any event, however, the committee insists that the new plant required is a replacement, the entire expense of which is chargeable to the Union Gas & Electric Company and must be paid by that company without any possible hope of any future reimbursement from the Cincinnati Gas & Electric Company.

During the last fifteen years the Union company has been operated without setting aside any amount toward a depreciation fund to cover the elements of decrepitude, obsolescence or inadequacy of the plant it leases. Its books have meanwhile shown the accumulation of a surplus which, the committee maintains, should have gone back into the property for offsetting depreciation. For 1912 this surplus was $208,000, and for 1911 $329,000. Officials of the Union company declare, however, that the terms of the lease required no such establishment of any depreciation fund. The recently enacted public-service commission law of Ohio does, however, specify that such depreciation allowance be set aside for property renewals, although this applies only to the past two years of the lease's term.

The stockholders' committee in a letter to President W. J. Hauck, of the Cincinnati company, has urged cancellation of the lease to the Union company on the grounds that the latter has exploited the property without proper care of the owners' interests and that the lessee has been virtually returning capital investment to stockholders in the guise of dividends. Protest is also made against the plan to transfer the Union company's lease to the Columbia company by the latter's purchase of the balance of $3,000,000 remaining, and it is also pointed out that such transfer cannot in any case be consummated without the written consent of the Cincinnati company stockholders.

No estimate is available of the amount of stock represented by the protective committee. While the leasing interests are disposed to discount the seriousness of this protesting movement, the fact nevertheless remains that should the charges brought by even a single shareholder be proved, forfeiture of the lease might follow. It also seems that the temper of many of the Cincinnati underlying stockholders is such that should the present agreement be abrogated no lease would again be entered into with an operating company, for the Cincinnati Gas & Electric Company would doubtless under circumstances of that kind undertake to operate its own property.

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## Transportation Facilities in New York

Mr. Frank Hedley, vice-president and general manager of the Interborough Rapid Transit Company, of New York City, addressed the Electric Club of Chicago on June 26 on "Transportation Facilities in New York." He remarked that the daily newspapers probably had more to do with transportation problems in large cities than any other agency. The papers seem to be looking for sensational stories rather than honest recitals of fact. The only way to secure the rational development of transportation lines is for the owners and managers of the properties and the city authorities to get together and lay all their cards on the table, as the saying is, so that there may be a "square deal" for all. As a matter of fact neither the companies nor the public has had a square deal for many years, principally owing to the harmful activities of the newspapers and politicians.

In New York it is believed that the problem of furnishing adequate transportation at a minimum fare has been solved finally. Mr. Hedley reviewed the growth of transportation facilities in New York City. One interesting statement he made was that for a number of years the damages paid for accidents have been about 3 per cent of the gross receipts. Considering the congestion in New York streets, the operation is good. The records show about one collision with other vehicles for every 7000 car-miles operated. The speaker remarked that the subsurface contact system of electric railway operation, such as is used in New York, is very difficult to maintain, for a variety of reasons. The surface, elevated and subway railways in New York have 21,000 employees and about 4500 cars in daily service. On the elevated lines the minimum interval between trains is fifty-two seconds, and in the subways the minimum interval between ten-car trains is one minute and forty-eight seconds. The speaker referred in terms of approval to the automatic speed-control system used in the subway. The greatest number of passengers on the elevated and subway lines carried in one day was 2,431,000. The business of the elevated and subway lines has increased by more than 100 per cent in six years.

Mr. Hedley advocated the plan of the city pledging its credit for extending transportation facilities. The municipality receives ample return by the enhancement of real estate values in outlying districts, and the rapid growth of the Bronx was cited as an example of this. The speaker pleaded for fair treatment of transportation companies by the public and city authorities and said that the companies should be permitted to receive a fair return on the capital invested. It is unfortunate that the municipal officers as a rule do not make a deeper study of transportation questions. The Public Service Commission of New York, First District, has done a great deal to bring about real rapid transit in New York City. Mr. Hedley declared his belief in commission control as a result of his experience. He described in some detail the plan entered into for the purpose of financing recent subway extensions in New York.

## A. I. E. E. Convention at Cooperstown, N. Y.

An account of the first two days' sessions of the annual convention of the American Institute of Electrical Engineers held at Cooperstown, N. Y., June 23 to 27, was given in these columns last week. Following is a report of the remaining days of the convention, while on other pages of this issue will be found abstracts of convention papers and the discussions which they provoked.

The technical sessions of the convention followed closely the prearranged program. A meeting of the board of directors of the Institute was held at Cooperstown on Wednesday evening, but the business discussed related largely to routine affairs.

The executive committee of the committee on organization of the International Electrical Congress to be held at San Francisco in 1915 met Thursday afternoon, but took no formal action although general matters of organization were discussed.

### Presentation of Edison Medal

On Thursday evening in the grand ballroom of the Hotel Otesaga occurred the annual award of the Institute's Edison Medal "for meritorious achievement," conferred this year upon Mr. William Stanley, the fourth recipient of the honor. The presentation was made by President-elect Mailloux in the absence of Dr. Elihu Thomson, who was to have delivered the address of the evening. Mr. Mailloux sketched in a reminiscent vein the achievements of Mr. Stanley during thirty years of inventive activity in the electrical field, paying eloquent tribute to his work in direct-current and alternating-current generation, transmission and transformation.

Mr. Stanley responded with modesty, pointing out the debt of the commercial inventor to the discoveries of pure science, whose work has laid the foundations for the electrical industry. A note of warning was, however, sounded by Mr. Stanley, who questioned whether the present great commercial organizations accomplish the true purposes of our newer arts. Modern monopoly and brute control, he intimated, tend to misappropriate the great gifts which mankind has received from scientists, inventors and engineers.

### Conferences on Institute Affairs

On Tuesday, Wednesday and Thursday there were informal luncheons of the section delegates, with Chairman P. M. Lincoln presiding. After some lively discussion a number of resolutions were finally adopted, being in substance: First, that the directors be requested to hold annual conventions at more accessible places and nearer large centers of population; second, that the minutes of delegates' meetings be forwarded without delay to each attending delegate; third, that an executive committee of five delegates be appointed by the chairman; fourth, that the directors be urged to adopt the Baldwin committee report on participation of sections in Institute affairs.

### Reports of Section Delegates

On Thursday evening there was a general conference of officers and section delegates.

Dr. J. B. Whitehead, speaking of the experience of the Baltimore Section, referred to the problem of making the meetings attractive and stimulative to members. The Institute work can be brought before the men, but it is difficult to get creative work on the latter's own account.

Mr. N. J. Neall told of the peculiar conditions in Boston, where both joint meetings and college meetings are held. The general meetings are not so successful as might be wished, although the serving of refreshments has been found to increase the attendance.

Mr. R. H. Rice said that the chief difficulty in Chicago is to reach the Institute members and interest them. The local section co-operates with the electrical section of the Western Society of Engineers, and they have very satisfactory joint meetings, with 100 to 150 in attendance. The latter society has, however, a total of about 1100 members. Successful co-operation has also been obtained with the new Chicago branch of the A. S. M. E.

Mr. J. C. Lincoln said that at Cleveland successful meetings are held at different industrial plants.

Prof. A. R. Sawyer told of the meetings of the Detroit-Ann Arbor Section, held alternately in the two places, 30 miles apart.

Mr. P. H. Haselton, of Fort Wayne, Ind., said that practically all of their members are connected with the General Electric Works, which causes some difficulty in maintaining interest in the meetings.

Mr. J. L. Wayne, Indianapolis, described conditions in the Indianapolis-Lafayette Section, where one meeting is held in the latter city for each two in the former. As the cities are 75 miles apart, there is no large interchange of attendance, although the sessions are fairly well filled.

Dr. F. Bedell, of Ithaca, N. Y., described the student division of the local section and said that meetings are held alternately for the regular members and the students. The annual banquet is very popular and student debates have proved a good feature.

### Lynn Section the Best Attended

Mr. A. W. Hall reported that the Lynn (Mass.) Section has a total of 548 members, 443 being local. At thirteen meetings last year the average attendance was 269, a larger sustained attendance than that for any other section.

Prof. E. Bennett, of Madison, Wis., said that the local section hopes to do effective work on pending state legislation. Each incoming chairman is also to attend the annual convention.

Mr. A. L. Abbott, of St. Paul, said that the average attendance at the Minnesota Section meetings was thirty-five to forty, drawn from both St. Paul and Minneapolis, between which the meetings alternate. At first the program committee tried to interest members in papers read at the New York meetings, but failed, and now they have local papers. Dinner meetings are also popular.

Mr. H. A. Hornor, of the Philadelphia Section, told of the good attendance secured by having a dinner before the meeting and a smoker afterward. There is also an annual outing given at the end of the year, the necessary funds being obtained by economical methods. The most important thing, said Mr. Hornor, is to give every member something to do. Discussions are short and copies are distributed in advance.

### Joint Meetings at Pittsburgh

Mr. E. L. Farrar, of Pittsburgh, spoke of their successful joint meetings under the auspices of some of the Institute technical committees. An annual banquet is held in mid-winter.

Mr. W. C. Smith, of the Pittsfield (Mass.) Section, spoke of the usual lack of familiarity of the incoming chairman with his work, and emphasized the need of some plan of instructing him in handling section affairs.

Mr. H. M. Friendly, of Portland, Ore., said the attendance at the Portland Section meetings averages from forty to sixty. The Institute section has just affiliated with the local section of the N. E. L. A. Good fellowship is promoted by luncheons held at one of the hotels.

Mr. H. W. Crozier, speaking for the San Francisco Section, advocated set programs. During the past year both a dinner and a luncheon were given in honor of visiting Institute men, which were very successful. They also hold dinners, costing $1, at different places in advance of the meeting and have an attendance of fifteen to twenty. The effect of competition for local interest from the Jovian Order and the Electrical Development Society is felt, he said.

Mr. J. B. Taylor reported that the Schenectady Section has about 600 members, one-half of whom are local and contribute dues of $2 annually. Meetings are held monthly but there is no set program. The section is managed on a broad policy in the interests mainly of the younger men. Outside speakers are obtained from time to time.

Mr. M. T. Crawford spoke for the Seattle Section, which is governed by an executive committee. The chairman and secretary, who have succeeded themselves in recent years, alternate in attendance at the annual convention. The whole local membership is divided into committees parallel to the Institute technical committees, and to each committee there is given charge of one meeting.

Mr. F. J. Bullivant said that the St. Louis Section cooperates with local engineering societies. Funds are derived from dues from local members and from special assessments.

Mr. M. Neuber, of Toledo, said that the section in that city has about the same trouble as the others. The committees have programs of considerable variety and adopt all sorts of methods to hold the interest of the members.

### New Institute Section at Spokane

Mr. J. B. Fisken, of the recently organized Spokane Section, said that sixty-three local members have already been secured. The principal activity thus far has been the drafting of an electrical code for metalliferous mines. There are large sections of the civil and mechanical engineering societies in Spokane and the prospects for the electrical section are bright. A papers committee can sometimes be more active than is desirable and make the mistake of securing too many papers.

Prof. A. M. Buck, of Urbana, Ill., explained that his section is both one of the oldest and one of the smallest. This section depends, not upon the students, but upon the university faculty and staff. However, the students have a fine engineering society of their own, and he thought they ought to merge with the section in giving impetus to the latter's activities and usefulness.

Mr. F. D. Nims, of Vancouver, spoke of the success of the dinners and smokers. The section usually has a set program but departs from it as may seem expedient.

Chairman Lincoln announced appointment of the delegates' executive committee as follows: Messrs. P. M. Lincoln, N. J. Neall, J. L. Wayne, H. A. Hornor and F. D. Nims.

### Entertainment and Games

The entertainment committee, Mr. W. C. Smith, Pittsfield, Mass., chairman, and the games committee, Mr. F. Osgood, of Newark, N. J., chairman, made extensive arrangements for the entertainment of the ladies and for games and contests of various kinds. Launches and boats, golf links, tennis courts and bathing pier were all available to delegates and guests. Late Tuesday afternoon nearly the whole convention participated in a 20-mile boat-trip around Lake Otsego. The ladies were also entertained with automobile trips, golf tournaments, card parties, etc.

An illustrated lecture on the Panama-Pacific Exposition, San Francisco, Cal., 1915, was presented on Wednesday evening by Mr. H. W. Crozier. Afterward an impromptu "electrical show" was thrown open in the hotel, with a number of clever caricatures of leading electrical manufacturers.

Two silver cup trophies were offered for the golf tournament. Of these it was explained that the handsome silver cup presented by President Mershon must be won twice successively at Institute conventions before becoming the permanent property of the victor. Other prizes were offered for the tennis tournament, ball game, ladies' putting contest, whist and heart games, longest automobile trip to Cooperstown, largest fish caught during the convention, and a number of others.

Nineteen contestants entered the golf tournament and the finals were played off between Prof. C. A. Adams and Mr. A. M. Schoen, the latter winning. The same number entered the tennis tournament, and in the finals Mr. G. A. Sawin won from Mr. C. T. Mosman. On Thursday afternoon, despite unfavorable weather, the ball game was played. Captain F. Osgood and a nine composed of Messrs. Sawin, Farrar, Bentley, Mosman, Peck, Kelsay, Thurston and Creighton played against Captain Hall with a team composed of Messrs. Norris, Dewey, Craighead, Lloyd, Newbury, Upson, Hollins and Bocian. The latter won, 13 to 8.

In the ballroom on Thursday afternoon a lecture and recital on Chopin was given by Prof. V. Karapetoff, whose accomplishments in music have brought him no inconsiderable fame. Between the numbers on the program Professor Karapetoff discoursed in an interesting way on the life and character of Chopin and their influence on his compositions.

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## Convention of Canadian Electrical Association

The twenty-third annual convention of the Canadian Electrical Association was held in the Chemistry and Mining Building of the Toronto University, Toronto, Ontario, June 25, 26 and 27. Owing to the fact that invitations had been extended to many persons interested in the electrical development of Canada to discuss the future of the association, especially with regard to a continuance of its affiliation with the National Electric Light Association, the attendance was quite large, 270 members and guests having registered. As pointed out below, the counsel of those best qualified to pass on the merits and demerits of affiliation with the National Electric Light Association prevailed, so that the Canadian Electrical Association will still remain a geographical section of the larger body.

### President Bird's Address

In his address President W. L. Bird, of the Kaministiquia Power Company of Fort William, Ont., called attention to the revolutionary character of the changes which have taken place in the electrical industry during the past few years, the enormous strides made in the transmission of energy with tensions as high as 150,000 volts, the rapid development of the electrical vehicle, and the great part electricity now plays in the life of the community. He exhorted the members of the association to exert every effort to keep up with and if possible in advance of the progress in electrical development, because apparatus which was considered the climax of inventive genius a few years ago is being rapidly discarded for better and more efficient devices, and competition is becoming so severe that only the fittest can survive. The increasing growth brings with it responsibility, and so close is the dependence of one part upon another, he said, that if anything fails, the whole system is tied up. In his opinion less attention can profitably be given to the question of rates and more to continuity of service. The latter should be the aim of every company in the business and should be secured at any cost.

### Growth of Association

The report of the secretary-treasurer, Mr. C. E. Bowden, of the Toronto Electric Light Company, Ltd., was presented in two sections, January to June, 1912, and June to June, 1913, covering a period of eighteen months. Gains in membership in all five classes were announced, the total membership of the association now being 619.

### Future of the Association

At the session on June 26 there was a very general discussion as to the future of the association. Mr. T. S. Young gave the results of a canvass made by the *Canadian Electrical News* at the suggestion of the association. Over 1000 letters were sent out to private plants, municipal

plants, contractors, electrical engineers and manufacturers requesting an opinion as to whether the association should continue as a geographical section of the National Electric Light Association or reorganize as a distinctly separate body. Of the replies received forty-one central stations were in favor of a change and fourteen were opposed; thirty-five municipal plants, sixty-nine manufacturers, thirteen consulting engineers and fifteen contractors also favored a change in the scope of the organization, while three municipal plants, eleven manufacturers, four consulting engineers and four contractors were against any change. Mr. A. A. Dion pointed out that the present organization does not differ from the old Canadian Electrical Association except that municipal plants which were formerly associate members and had no voice are now not admitted into membership at all. For purely business reasons, he said, an association such as the Canadian Electrical Association is necessary. At the meeting of the executive committee later in the day it was decided not to make any change.

### Election of Officers

The following officers were elected for the year 1913-1914 as announced at the closing session: President, Mr. D.

PRESIDENT-ELECT D. R. STREET

R. Street, of the Ottawa Electric Company; first vice-president, Mr. A. L. Mudge, of the Electric Power Company, Toronto; second vice-president, Mr. D. H. McDougall, of the Toronto Electric Light Company, Ltd.; third vice-president, Mr. Wills Maclachlan, of the Trenton Electric & Water Company, Belleville; honorary secretary, Mr. T. S. Young, of Toronto; secretary-treasurer, Mr. H. G. Martin, of the Toronto Electric Light Company, Ltd. The managing committee comprises Messrs. A. A. Dion, of the Ottawa Electric Company; J. S. Gould, of the Citizens' Electric Company, Smith Falls; F. G. Clark, of the Toronto Power Company; L. Pratt, of the Dominion Power & Transmission Company, Hamilton; R. S. McDunnough, of the North Shore Power Company, Three Rivers; H. G. Mathews, of the Quebec Railway Light & Power Company; E. L. Milliken, of the Cape Breton Electric Company, Sydney, N. S.; W. L. Bird, of the Kaministiquia Power Company, Fort William; W. L. Robertson, of the Electric Power Company, Toronto; A. E. Dunlop, of the Pembroke Electric Company, Toronto; R. M. Wilson, of the Montreal Light, Heat & Power Company; R. H. Sperling, of the British Columbia Electric Railway Company, Vancouver; R. J. Smith, of the Canadian Electric & Water Power Company, Perth, and W. G. Angus, of the Dominion Power & Transmission Company, Hamilton.

Lieutenant-Colonel D. R. Street, the president-elect of the Canadian Electrical Association, is secretary-treasurer of the Ottawa Light, Heat & Power Company, the Ottawa Electric Company and the Ottawa Gas Company. He has been connected with the electrical interests in Ottawa since 1893. In that year he accepted a commission in the Governor General's Foot Guards, and, by gradually accepting promotions in their due course, succeeded to the command of the regiment in April, 1908, which regiment he commanded at the tercentenary celebration in the city of Quebec, and he also commanded his regiment at the tercentenary celebration of the discovery of Lake Champlain, where he was the guest of the states of New York and Vermont. Colonel Street, although a busy man with his civic occupation and his military duties, has always taken a keen interest in matters pertaining to the Canadian Electrical Association, and was a strong advocate of the affiliation of the Canadian association with the National Electric Light Association. His election to the presidency of the Canadian association came as a surprise to him and was wholly unexpected, as he was not present at the convention, his absence being due to business causes.

### Entertainment Features

On the evening of June 25 there was a theater party at the Royal Alexandra Theater, to which all were invited. Thursday morning the ladies in attendance were taken for a ride about the city and entertained at luncheon at the Royal Canadian Yacht Club. In the afternoon there was a baseball match between the manufacturers and central-station men at the Aura Lee Club grounds, which resulted in a victory for the central-station men with a score of eleven to four. That evening a cabaret show was given at the Temple Building, followed by dancing.

One of the most interesting papers at the convention was that dealing with underground construction in small cities, an abstract of which is given below as well as an abstract of the paper on organization of an appliance department. Abstracts of other papers will appear in a later issue.

### Underground Distribution for Small Cities

In large cities the load density makes overhead construction in congested districts a difficult and expensive proposition, so that economic requirements and esthetic demands are very apt to become coincident factors and underground construction does not become a burden upon the operating company. In the case of smaller cities, however, the problem is vastly different, and in a paper prepared by Mr. S. B. Hood, of the Toronto Electric Light Company, Ltd., on "Underground Distribution for Small Cities" it is pointed out that in small cities the load density and corresponding income will not warrant expensive underground distribution, so that a yielding to the demand for this class of distribution must inevitably place an additional burden upon the community as a whole or at least that portion of it which patronizes the local distributing company. Where the cost is charged as a local improvement against the abutting property owners, the cry for all wires underground becomes very much subdued, and while it is possible for municipally operated systems to handle the proposition in this way, privately owned companies cannot do so. Mr. Hood in his paper outlined a type of underground distribution which has been tried successfully in Toronto for locations where the demand for underground has been such that no form of overhead construction would have been acceptable. Two lead-sheathed, paper-insulated cables are laid in the earth with a bare neutral between them. The combined cost of these and the bare neutral will not exceed the cost of a three-core armored cable, besides possessing all the advantages of two independent two-wire systems as to reliability and continuity of service. In laying these cables about 4 in. of earth should separate each conductor from the bare neutral and about 8 in. from the outers. The group of cables thus separated should then

be buried in from 4 in. to 6 in. of earth and covered with a board of 1-in. rough lumber, treated with carbolinium and the ditch then filled in. There is in Toronto to-day somewhat over 6000 ft. of this type of main which has been in use for over two years. This was laid in new residential streets where building construction was in process and with the certainty that three ditches would be dug over the company's main for every new dwelling erected. Under these conditions no interference or failures have occurred, and in opening up the street for new services from time to time no depreciation is visible on the cables. It was pointed out that the construction was in unfinished boulevards with sandy soil and that the outer cables were only of No. 00 cross-section. The cost was about 80 cents per ditch foot or $1.60 per foot of street with mains on both sides. The original supply for this street was by overhead lines at a cost of about 30 cents per foot of street, which means under the most favorable conditions that underground construction will cost five times more than overhead construction.

The alternating-current mains are fed from pole-type transformers erected on intersecting streets, and in order to provide against extensive outages due to trouble on any section of the mains, and also for sectionalizing of the main on either side of any block, each block is fed from each end, the transformers being located at the extreme ends of the system in order that no block may have its supply limited to one source. This arrangement permits the opening of any main for repairs or changes without interfering with the supply to any customer. The trouble with such a scheme is the difficulty of making a good job in bringing the eight cables (two pairs for the block on which the transformer is located and two pairs for the block beyond) up the terminal pole. To overcome this a pillar box is used. The latter is supported on two concrete piers going down below the frost line, and the box is secured by a pair of anchor bolts embedded in the concrete. In the standard box terminals are provided for ten outgoing leads on both positive and negative sides of the system. The polarity is separated by an intervening and removable asbestos board, which makes it easy to work without danger of short-circuit and provides a quick means of testing and sectionalizing without the necessity of going up the pole or opening manholes. The cost of this pillar box built with hot galvanized finish throughout is about $100. With a system of this kind, the author pointed out, industrial service must be carried on single-phase motors, and where objection to this type of motor is made because of the higher cost the supply company, in the opinion of the author, can afford to pay the difference rather than yield to the demand for a polyphase supply on which the excess investment for mains, services and meters will be considerably in excess of the difference in the cost of the two types of motors. In concluding, Mr. Hood called attention to the desirability of having the primary supply for the suggested underground system arranged as a ring main. The secondaries, to get full advantage of diversity factor and consequent low copper and transformer costs, must be interconnected.

Mr. Hood's paper, which contained valuable information for central stations, was discussed by Messrs. L. W. Pratt and W. G. Angus, of the Dominion Power & Transmission Company, Hamilton; A. A. Dion, of the Ottawa Electric Company; J. Croucher, of the Toronto Electric Light Company, Ltd.; W. H. Marsh, of the Standard Underground Cable Company, Ltd., of Hamilton, and A. L. Mudge, of the Electric Power Company, Ltd., of Toronto. The discussion was simply directed toward explaining more fully some of the details of the paper.

### Organization of an Appliance Department

Mr. B. E. Rowley, of the Hot Point Electric Heating Company, Ontario, Cal., in a paper entitled "Organization of an Appliance Department," said that the perpetual earning capacity of such a department is certainly sufficient to justify the personal attention of the manager of a lighting company at times, although the routine work may be placed in charge of an appliance department manager. The author discussed the subject of the organization of an appliance department under various heads and showed forms used by the appliance department of the Southern California Edison Company, of Los Angeles, Cal.

*Discussion*

Messrs. L. W. Pratt, of the Dominion Power & Transmission Company, Ltd., Hamilton; A. A. Dion, of the Ottawa Electric Company, and G. W. Magalhaes, of the Toronto Electric Light Company, Ltd., contributed to the discussion on Mr. Rowley's paper. It was brought out that a bulletin board in the main office of any central station on which the advertisement for the day can be placed would insure united effort on the part of solicitors, demonstrators, window trimmers and the advertising department.

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## Convention of the British Municipal Electrical Association

In his presidential address delivered before the eighteenth annual convention of the Incorporated Municipal Electrical Association at London, June 17, Mr. C. E. C. Shawfield, Wolverhampton, directed attention to the need for a cheap supply of electricity, which, he insisted, is as necessary to the welfare of the community as adequate water supply or drainage. The increasing use of central-station service by factories, he pointed out, has purified the air near cities, although at the same time obviating fogs which formerly contributed to improving the lighting load-factor. The speaker deplored the policy which, while permitting municipalities to expend large funds on generating and distributing systems, prevents them from entering the business of equipping customers for the use and consumption of energy. Urging furtherance of the central-station idea, Mr. Shawfield recommended lowered municipal rates as being ultimately productive of the greatest possible development.

### Prime Movers for Electric Power

In considering kinds of fuel for prime movers, Dr. S. Z. de Ferranti emphasized the importance of Great Britain as a coal-producing country, but declared that in the future all coal must be gasified to obtain the high efficiencies of from 20 to 22 per cent available with the internal-combustion engine. The oil engine offers still higher efficiencies, ranging from 28 to 30 per cent, with no stand-by losses at partial loads. From the labor standpoint, however, the rotary class of machines like the turbines will always have tremendous advantages over reciprocating units, due to the simplicity of the former. Internal-combustion engines, on the other hand, are handicapped in handling overloads, and also possess the disadvantages of occupying greater space and being more expensive. Looking to the future, Dr. Ferranti predicted the day when with turbines using the internal-combustion principle still better economies will be obtained.

### Air Filtration and Cooling of Electrical Machinery

In a paper by Mr. J. Christie, Brighton, were described methods of ventilating large generating machines, removal of dust from air, etc. Ordinarily cloth filters are employed for this purpose, allowing 0.2 sq. ft. per cubic foot of air per minute. The author described an improved water-spray filtering apparatus in use at Southwick, where the air for ventilating a large machine is passed first through a water screen from a bank of nozzles and is then freed of entrained water particles by baffle chambers. The advantages claimed are compactness, absence of fire risk, ease of cleaning, low resistance to air passage, and incidental cool-

ing of air. Owing to this cooling action the author believes that from 10 to 15 per cent additional output can be obtained from fully loaded machines. The degree of humidity incident to use of the water spray is about the same as that obtained with cloth filters.

### Electric Automobiles

A paper on "Electric Automobiles," by Messrs. A. H. Seabrook, W. H. L. Watson and R. J. Mitchell, was largely devoted to description of practice and construction methods in the United States which the authors recommended be followed by the British industry. Lead and nickel-iron storage batteries were described, charge and discharge curves being given. Details were presented of the principal forms of transmission and bearing mountings, and motors, systems of control, tires, etc., were discussed in detail. The paper closed with a compilation of electric-delivery costs for both trucks and light wagons. In an appendix was given a collection of illustrations showing typical American electric-automobile equipment.

The headquarters of the convention were at the Hotel Cecil, where also was held the annual dinner on the evening of June 18. All of the regular sessions were held at the Institution of Electrical Engineers, Victoria Embankment, with the exception of the June 19 meeting at Kingston-on-Thames. The entertainment features of the convention included inspection trips to the Deptford, West Ham and Chelsea stations, a boat trip on the Thames from Nuthalls to Weybridge, and several dinners and luncheons.

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## Society for Promotion of Engineering Education

The twenty-first annual meeting of the Society for the Promotion of Engineering Education was held at the University of Minnesota, Minneapolis, June 24 to 26. The registered attendance numbered about 10 per cent of the membership, which was satisfactory in view of the fact that the meeting was this year held farther west than any previous one.

Among the conspicuous features of the program were (1) a series of papers on the design and construction of buildings for technical schools, (2) papers on hydraulic engineering education presented at a joint session with the American Water Works Association, (3) a symposium on highway engineering education, comprising a long series of papers by eminent highway engineers and teachers of the subject, (4) a paper by a representative of the Pennsylvania Railroad on co-operation between technical schools and the industries, and (5) a paper by a prominent manufacturer advocating a movement in the direction of standardization of technical terms. In addition there were other carefully planned papers dealing with details of administration of various courses and with the underlying principles of successful administration.

### Academic Efficiency

Last year at the Boston meeting of the society a number of experts on scientific management showed that there was a connection between this subject and education. This year Director H. S. Person, of the Tuck School of Administration and Finance, Dartmouth College, was requested to apply the principles of scientific management to college administration. In doing so he showed that by functionalizing college work greater efficiency can be obtained than by present methods. The functions involved in education are teaching, administration, advising, and guiding non-class-room educative influences. As teachers are not equally fitted for all functions, it is advisable to assign to each only those for which he is best adapted.

Professor Person does not agree with the statements sometimes made that because education deals with intangible material the principles of scientific management do not apply to it. Further he believes that, contrary to the usual view, the more functions the instructor is called upon to perform the less personal is his contact with the student. Finally he contends that teachers and administrators do not apply scientific methods of research in education and that this is an important cause of inefficiency.

### College Laboratory Construction

Three papers on building construction and laboratory arrangement took up different aspects of the problem. Professor C. R. Richards, of the University of Illinois, gave the results of studies made with a view to the enlargement of the laboratories of that university and including what he thinks to be an ideal arrangement for the conditions existing there. He finds that much more careful attention has been given to the details of office buildings than to the design of college buildings, if it can be called design at all. The demand for the largest space for the smallest expenditure has forced the erection of buildings which are architecturally unsatisfactory. He then outlined the requirements of good laboratory buildings and some of the features of the equipment which they are designed to house.

Profs. E. C. Schmidt and A. L. Williston described particular laboratory buildings at the University of Illinois and the Wentworth Institute respectively. The transportation buildings of the former were recently dedicated and were fully described in the technical press. The University has now a locomotive-testing plant to accommodate the usual types of steam and electric locomotives. When completed it will handle the heaviest Mallet compound engines, as the possible wheel-base is 90 ft. and the traction dynamometer capacity 125,000 lb. The new Wentworth Institute building, for which the ground is now being broken, will provide ample space for the mechanical and electrical laboratories and for administration purposes. The general building plan of the institute is on what is called the unit system, sections being three times as long as they are wide and with the supporting columns so placed as to permit the rearrangement of partitions with minimum expense. This institution, although in operation but two years, has already taken its place as an important factor in industrial education in the Boston district.

### Specialized Engineering Courses

There is a marked tendency away from a high degree of specialization in technical courses. Two sessions of the Minneapolis meeting were, however, devoted to the important civil-engineering branches of highway and hydraulic engineering education respectively, on account of the public interest in these subjects at the present time.

At a session held jointly with the American Water Works Association, Prof. S. D. Mead, of the University of Wisconsin, and O. L. Waller, of the State College of Washington, read papers covering the preparation of young men as hydraulic engineers. As might have been expected, the papers and the discussion following would apply almost equally well to any other branch of engineering instruction. In fact, the authors showed that the best preparation for a hydraulic engineer is that which will teach him to think. As Professor Mead stated, the value of any education is not so much in the acquirement of knowledge as in the ability to acquire it. The ability to analyze a problem, to investigate the conditions which surround it and to determine the fundamental principles on which a successful solution depends are among the aims of a true education. He pointed out that the tendency of educational methods is to discourage the development of judgment, for the students are apt to accept the dictum of their teacher as infallible and hence not subject to their critical inspection. This, if true, is unfortunate, as sound judgment is an attribute of the successful engineer.

Professor Mead contended for a place in the civil-engineering curriculum for hydrology, a subject so essential in all water-power, irrigation and drainage projects, but one which is overlooked in the average list of courses of instruction. Professor Waller covered somewhat the same ground from the educational side, but he also urged a closer union between theory and practice by sending students into the field for commercial work for which a limited amount of college credit should be given. Discussion of these papers brought out the value of a technical education to the hydraulic engineer, but emphasized the primary purpose to be a general preparation for life rather than a specific preparation for hydraulic engineering.

The titles of the papers composing a long symposium on highway engineering education would lead one to infer that the educational situation in this field is different from that in others. Among these titles are "Essential Qualifications for Highway Engineers," "Opportunities for Highway Engineers in State Departments," "Short Winter Courses in Highway Engineering," "The Humane Element in the Education of Highway Engineers" and "Financial Problems in Highway Engineering." The papers showed, however, that the art and science of road making should be understood by all civil engineers and, while the opportunities in this field are unusually attractive at present, this should not result in the giving of highly specialized undergraduate courses in the subject. The present activity in highway engineering is due to the action of state legislatures in appropriating large sums for roads. The call for men fitted to take immediate positions of responsibility is, for the time, greater than the supply. Hence there is a pressure on the schedule for practical instruction outside the natural field of the technical school. This must be resisted. The elements of success in highway engineering are not different from those required in hydraulic, mechanical, electrical and other branches of engineering.

### College Students and the Summer Vacation

There is no doubt that the summer vacation must be profitably employed if a technical education is to be efficient. In hydraulic engineering it may be spent in field work, in irrigation and other water-works, as Professor Waller pointed out. Professors Sherman and Schlafly, of the Ohio State University, explained how their students are encouraged to get into commercial work in the summer time. If this is impracticable, the instructors take commercial contracts and employ the students as assistants. These "practical" summer surveying camps take the places of "practice" camps and are giving excellent results. Under this plan the students feel and act more like engineers than under the old plan. Prof. F. P. McKibben, of Lehigh University, gave details of the experiences of his students in obtaining summer employment and of the excellent results obtained therefrom. The discussion brought out a general sentiment in favor of the use of the summer months in actual work and emphasized the duty of future employers of the men to provide such work for them.

### The Length of the Engineering Course

A marked tendency to lengthen the college course to five or even six years has been conspicuous of late. A number of schools have introduced longer courses, these being either required or optional. This tendency is opposed by some leading educators, and two of them, President A. C. Humphreys of the Stevens Institute of Technology and Prof. G. F. Swain, of Harvard University, vigorously voiced their opposition at the Minneapolis meeting. They claim that four years cover a period long enough for a boy to remain from actual work and that the expenditure of an extra year or two does not bring commensurate results. In championing the other side the advocates of the longer course pointed out that the extra time is not wanted for more technology but for studies selected to prepare for better citizenship, and that on this basis its use is justified. Obviously no agreement was reached or could be reached as to the proper length of a course, but the discussion served to keep the topic alive and to put the authorities in charge of technical schools in a defensive attitude toward their present practice whatever that may be.

### Grading Students

At the University of Missouri an unusual amount of attention has been given to the grading of students along psychological lines. All teachers know that a numerical grading is quite perfunctory, as it is the impression made by a student upon his instructor rather than the written work he turns in that eventually "passes" him in a given course. A study of the practice of a large number of teachers was recently made by Prof. Max Meyer, and on the basis of this a considerable modification of the system of grading was made at the University of Missouri some years ago. The results were described by Prof. A. L. Hyde as entirely satisfactory. There are five grades given—excellent, superior, medium, inferior and failure. It is assumed that each teacher knows intuitively to which grade a student should be assigned. That this assumption is correct is proved by the much greater uniformity of ranking under the new plan. In addition to the advantages accruing from the psychological correctness of the system the student is offered an incentive to do good work by rewarding him for obtaining high grades with increased credit, while he is penalized for receiving low grades even if he does not have to repeat the courses for which he receives them. In this way the good student can reduce the length of his college residence while the poor student must consume more than the standard time if his grades, although passing, are low.

### Engineering Nomenclature

A subject which affects all engineers, because it relates to the ease and understanding with which they can read technical literature, is the standardization of technical terms. Mr. D. M. Wright outlined the results of his experience in a paper in which he recommended the appointment of a committee to study the subject. He described the results of a recent investigation in which a picture of a machine was sent to a number of manufacturers with the request that they name its parts. The returns showed that there is absolutely no unity in nomenclature, each man having his own terms, which were in many cases crude. Mr. Wright's idea is that the Society for the Promotion of Engineering Education is a proper agency through which some reform can be brought about, as educators are in a position to promulgate a reform of this kind. The findings of a committee which will be appointed shortly to consider Mr. Wright's suggestions will be awaited with interest.

### Faults of Technical Graduates

At the request of the society a representative of the Pennsylvania Railroad, Mr. Ivy L. Lee, gave the results of the experience of that company with the many technical graduates who have entered the company's employ. The faults which they have noted are as follows:

(1) A lack of practical experience and judgment.

(2) An idea that they are far superior to the rest of mankind.

(3) A certain narrowness of mind, inculcated through a too exclusive attention in college to mathematics and theoretical science and to a too great neglect of those broader subjects such as political economy, history and general literature.

Mr. Lee believes that these faults can be overcome and that, by directing attention to the shortcomings and limitations as well as the strong points of the students, teachers

can do much to assist them in eliminating their weaknesses. This is a time for social service in public utility commissions, in colleges, in university settlements, in municipal health boards, in city governments, in all capacities in which men can serve their fellows. The demand in all lines is, in Kipling's words:

"From forge and farm and mine and bench,
Deck, altar, outpost lone—
Mill, school, battalion, counter, trench,
Rail, senate, sheepfield, throne—

"Creation's cry goes up on high
From age to cheated age;
Send us the men who do the work
For which they draw the wage."

### Manual Work for Students

Two important features of all technical courses are shopwork and drawing. That these subjects are being taught upon a high plane was indicated by the papers of Prof. J. V. Martenis and Mr. W. H. Richards, of the University of Minnesota, and Prof. T. E. French, of the Ohio State University. While shopwork and drawing are different in kind, they are alike in principle. They are tangible expressions of ideas. If taught in a routine, mechanical manner, they lose their vital interest; if related to engineering life, they become efficient parts of the curriculum. Messrs. Martenis and Richards have made shopwork interesting by allowing the students to make things worth while and, as nearly as may be, under commercial conditions. Professor French has related elementary drawing to the needs of the students so that they may be impelled to the desire for expression in this form. If all engineering subjects can be taught in this way, combining thoroughness with interest, the student will be happier and hence more efficient.

### Teaching Elementary Dynamics.

Of all the difficult concepts which students have to grasp, that of the relation of force, mass, weight and acceleration is one requiring possibly the greatest mental effort. Teachers of mathematics, physics, mechanics and engineering struggle with it. The situation is aggravated by the use of many different units for these quantities. Prof. E. V. Huntington, of Harvard University, proposed a simplification of these by eliminating most of these units and substituting what he calls the "standard" weight and the "local" weight for the usual "mass" and "weight." These names are self-defining. Then if the standard weight of a body be known (say by applying a correction to the local weigh), the effect of any force on that body will be an acceleration proportioned to the quotient of that force and the standard weight multipled by the gravitational acceleration in the standard locality. Or

$$A = \frac{F}{W_o} \times g_o$$

Naturally a proposition like this stirred up much discussion and the whole subject was referred to a special committee on the teaching of mechanics to engineering students, which was appointed forthwith, with Prof. E. R. Maurer, of the University of Wisconsin, as chairman.

### Thesis Work for Undergraduates

The cause of the much-discussed thesis, once an essential part of the engineering curriculum, was championed by Prof. H. Wade Hibbard, of the University of Missouri, and many other teachers who believe that a limited amount of time may be profitably devoted to a research problem of some sort, provided that it be not too comprehensive. The satisfactory solution of such a problem demands careful preparation and systematic solution. Professor Hibbard has collected a list of 1500 or more topics for thesis study, which will be published in an early number of the *Bulletin* of the society.

### What an Instructor Should Be

In his presidential address Prof. William T. Magruder, of the Ohio State University, painted a picture of an ideal instructor which showed that a man who occupies a position of such moral responsibility should be possessed of high character and attainments. He must, of course, be familiar with his subjects in both a theoretical and a practical way, but his knowledge must be within reach of his students. If they cannot understand him, he might better know less for their purpose. If possible, he should have earned his living in the line which he tries to teach so that he may be sufficiently practical in his instruction. He must be able to express himself clearly and forcibly, requiring for this purpose not only ability but health, adequate recreation and endurance. He must be a model to his students in character, involving honesty, right living and patience. He must have unbounded enthusiasm for engineering and for teaching, with conviction as to their dignity and importance. The good teacher is he who has felt the thrill of having been called to the upbuilding of character in others, who day by day sees the unfolding of the innermost life of service to live and enjoy, and who deals with human minds in the laboratory of life; for, after all, is not education only scientific research applied to character?

### Activities for Next Year

In addition to the plans for new work already mentioned, a number of committees appointed last year to study the improvement of instruction in the several branches of engineering reported progress and were continued for another year with instructions to carry out their own suggestions. The chairmen of these are Profs. F. P. McKibben, of Lehigh University; C. F. Scott, of Yale University; A. M. Greene, Jr., of Rensselaer Polytechnic Institute, and F. W. Sperr, of the Michigan College of Mines. The committee on college administration, which made a report covering such matters as the salaries of professors, falling off in the number of technical students, leaves of absence, etc., was continued. A new committee on the teaching of physics to engineering students, with Prof. G. V. Wendell, of Columbia University, as chairman, was also appointed. Altogether the society has a large amount of committee work in progress, greater than at any other time in its history.

### Business Session and Election of Officers

The governing body of the society comprises the usual complement of officers and a council. The latter includes the past-presidents in addition to twenty-one members, one-third of whom are elected annually. The following elections occurred this year: President, G. C. Anthony, Tufts College, Mass.; vice-presidents, H. S. Jacoby, Ithaca, N. Y., and D. C. Humphreys, Lexington, Va.; secretary, H. H. Norris, Ithaca, N. Y.; treasurer, W. O. Wiley, New York, N. Y.; councilors, H. W. Tyler, Boston, Mass.; J. F. Hayford, Evanston, Ill.; A. S. Langsdorf, St. Louis, Mo.; S. M. Woodward, Iowa City, Ia.; M. S. Ketchum, Boulder, Col.; F. P. Spalding, Columbia, Mo., and P. F. Walker, Lawrence, Kan.

Several important actions were taken at the meeting. The council voted to take the steps necessary to bring before the membership a plan to make the secretaryship permanent. Princeton was recommended for the 1914 meeting and California for the year following. The secretary was instructed to confer with the officers of other societies with a view of reducing the conflict between convention dates. The wisdom of this action is seen when one considers that this year during the same week as the Minneapolis meeting the American Institute of Electrical Engineers met in Cooperstown and the American Society for Testing Materials in Atlantic City. At the same time many members were abroad on account of the tour of

the American Society of Mechanical Engineers and of the Highway Congress in London. As the educational society draws its membership from all engineering societies, attendance at its convention is seriously affected by such conflicts.

The social side of the Minneapolis convention was, as usual, made a feature, and excursions, receptions and luncheons enabled the delegates to renew old acquaintanceship and the younger teachers to meet the veterans in the teaching profession.

A novel element of the meeting was the presence of representatives of instrument manufacturers and publishers, with excellent exhibits of their products. The teachers were thus able to examine at leisure the latest books and apparatus with experts to explain them.

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## A. I. E. E. Convention Papers and Discussions

Herewith are presented abstracts and discussions of the papers read before the annual convention of the American Institute of Electrical Engineers at Cooperstown, N. Y., June 23 to 27, omitting, however, for lack of space, papers on the subjects of high-tension transmission, corona, and synchronous motors. An account of the news features of the first two days' sessions was given in these columns last week, and on a preceding page of this issue will be found a report of the closing days of the convention.

### An American General Engineering Society

Deploring the lack of a united engineering profession, Dr. William McCellan presented a paper in which he proposed the formation of a general engineering society, to be known as the American Engineering Association, which would include no personal memberships, but in which the present national engineering societies would participate by electing representatives annually. No business or trade organizations would be included. The present lack of unity, according to the author, has prevented the engineering profession from exerting its proper influence in the solution of economic problems and has also prevented the profession from having the standing it deserves among the learned professions. Among the functions of such a general engineering society as that proposed would be arrangement of an annual convention for the discussion of engineering in general, the holding of semi-annual meetings, investigation of various subjects, appearance in national and civic matters, etc. To carry such a scheme into effect, it should have the support of at least three of the four national engineering societies.

#### *Discussion*

Mr. C. O. Mailloux characterized the paper as one of the most interesting contributions presented in a long time. This, he said, is one of the means of raising the status of the engineering profession. Evolution in engineering has been largely a process of segregation, with many resultant different attitudes and opinions as to professional ethics, the relation of the engineer to public questions, etc. The American Institute of Consulting Engineers has given considerable attention to this question, but has considered only the interests of consulting engineers. The proposal in the paper, declared the speaker, should be fostered and promoted by the Institute, and to that end he offered a motion that it be referred to the board of directors for consideration.

Strong indorsement of the paper was next given by Mr. Oberlin Smith, of Bridgeton, N. J., a member of the four national engineering societies. He felt, however, that too much clannishness among members of different national engineering organizations exists to make the project feasible just yet. It was hoped, he said, that when Mr. Andrew Carnegie donated the Engineering Societies Building in New York the four great societies would come together under one roof, and he declared that the American Society of Civil Engineers has since regretted its action in staying out. The civil engineers, he said, still consider that their society represents all the domain of engineering except military engineering, although there is a growing sentiment among many of them for a united national society. Such a society, said Mr. Smith, should not be organized unless it embraces all of the present national societies.

He closed by seconding Mr. Mailloux's motion, which was then voted upon and carried.

Mr. C. L. Clarke, of New York, N. Y., who indorsed the plan of Dr. McClellan, urged that clannishness would be no obstacle to its accomplishment, because none of the functions of any of the constituent societies would be disturbed. He proposed the name of "American League of National Engineering Societies," as being both descriptive and sonorous.

Mr. D. B. Rushmore, of Schenectady, N. Y., deprecated the existence of too many professional and commercial organizations, many of which he regarded as superfluous and imposing an unnecessary financial drain. He also spoke of the proposal which has been made repeatedly for licensing engineers and believed that such a plan, if ever carried out, should be supervised by a unified national organization of engineers of every kind.

Prof. C. L. de Muralt, of Ann Arbor, Mich., indorsed the paper. He thought, however, the best plan would be to apply for representation in the American Society of Civil Engineers, making that organization ex officio the national body. This proposal met with objection at once from Mr. Mailloux, who took the floor and characterized such a plan as preposterous and ridiculous. The civil engineers, he declared, had lost their opportunity forty years ago and were both clannish and unprogressive in this respect. Prof. Muralt then defended his proposal, saying that the civil engineers would welcome such a plan, and that it would be entirely feasible.

Mr. Oberlin Smith declared that the civil engineers would be delighted, of course, to take everybody in on such terms, but agreed with Mr. Mailloux that the proposal was impossible.

Prof. D. C. Jackson, of Boston, Mass., indorsed the general plan. Speaking of Tredgold's well-known definition of engineering, he said he preferred to amplify it to the extent of defining engineers as those competent to conceive, organize and direct engineering work. And under such a definition it seems obvious that scientists should be included since they fall under the head of those who conceive.

### Tests of Artificial Telephone Line

Tests described by Dr. A. E. Kennelly and Mr. F. W. Lieberknecht were made on the 500-mile artificial line at Harvard University which had been converted to the characteristics of an aerial telephone line by the addition of non-inductive 100-ohm resistors at intervals of 80 km, increasing its resistance to about 2.5 ohm per wire-mile. The experiments included three sets of terminal conditions at the receiving end, the signals being sent by alternating current at 1.7 volts and 760 cycles per second. In the first set of tests the distant end was freed or open, in the second grounded, and in the third connected to ground through a standard subscriber's set. The results of the experiments, set down by the authors in tabular and polar-co-ordinate curve-forms, evince the close agreement with the theoretical conditions computed with the aid of the hyperbolic-function method.

#### *Discussion*

The paper was discussed briefly by Prof. D. C. Jackson, Boston, and by Mr. F. K. Vreeland, New York, N. Y. Prof. Jackson brought out the distinguishing characteristics

of telephone transmission and energy transmission, commenting upon their several points of general similarity and emphasizing the importance of the paper to energy-transmission engineers. The applicability of the hyperbolic-function theory, he said, is very clearly established by the experimental data presented.

Mr. Vreeland raised some questions in relation to the constants of the artificial line used in the tests described, and commented upon the very notable agreement between theory and practice. Mr. E. H. Colpitts, who presented the paper for the author, gave the results of some of his calculations from the observed results exhibiting discrepancies between the computed constants of the line and the

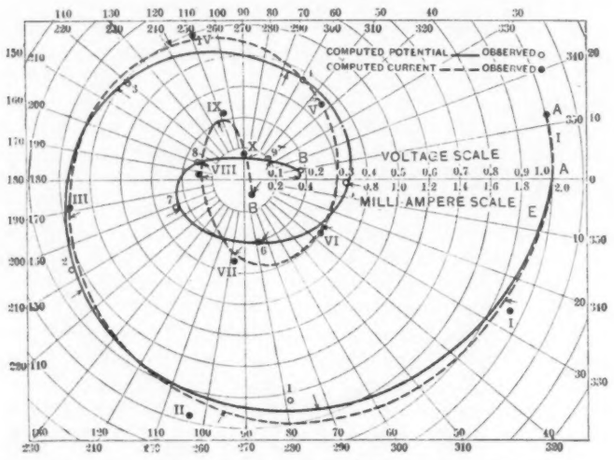



FIG. 1—VECTOR DIAGRAM OF VOLTAGE AND CURRENT

measured constants. In part the differences, he said, were attributable to the comparatively small number of artificial-line sections per wave-length. The line constants, so-called, are not constant but depend to some extent upon the frequency of the impressed emf.

### AUTOMATIC LONG-DISTANCE TELEPHONY

Since "line time" is the commodity of principal value in the operation of a long-distance telephone system, it is poor economy, as pointed out by Messrs. H. M. Friendly and A. E. Burns, to limit the expenditure for office switching equipment where proper investment of this kind will facilitate transmission efficiency to even a small degree. The human factor represented by the operator often determines the efficiency of operation to such an extent that any dependable equipment which will reduce this indeterminate element is well warranted, however complicated it may be.

The authors described with the aid of circuit diagrams equipment for eliminating the through operator at intermediate offices heretofore used in establishing connections where the service cannot be made over direct lines or where the traffic offered does not warrant direct-line service being provided. The function of the through operator is performed by apparatus in semi-automatic control of the terminal operators.

Equipment was also described for enabling a toll operator to call subscribers directly in a distant manual local exchange via the "B" board, without disturbing the toll operator at the called exchange, though such service is subject to the latter's supervision. This does not, however, restrict or modify the normal uses and operation of the toll line.

#### *Discussion*

In discussing the paper briefly Mr. J. B. Taylor, Schenectady, N. Y., remarked that the use of such elaborate and complicated equipment in telephone service seems sometimes justified, but, on the other hand, is questionable in certain instances. He commented on the disagreeable and occasionally painful mechanical shocks received by the ear when using an instrument operated by the common-battery system, and the desirability of preventing such shocks in any successful commercial system, manual or automatic. Mr. Oberlin Smith, Bridgetown, N. J., said that the advent of automatic systems is to be welcomed, and expresssed the hope that all telephone service would in due time be upon such a basis.

In closing the discussion, Mr. H. M. Friendly said that

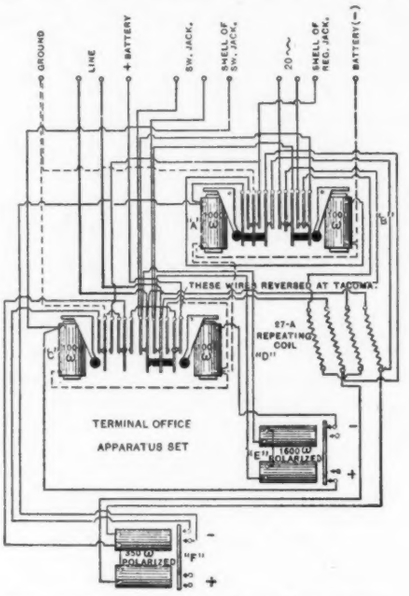



FIG. 2—THROUGH SWITCHING CIRCUIT

the application of automatic equipment to toll switching has been effected in such a manner as to make it click-less. He also reported that the maintenance charges upon such equipment were extremely low.

### ELECTROLYTIC CORROSION OF IRON IN SOILS

In a paper by Messrs. Burton McCollum and K. H. Logan was discussed generally the subject of electrolytic corrosion of buried iron from outside current sources as well as from self-corrosion within the piece itself. The two actions are to a large extent interdependent, the existence of one affecting largely the occurrence or severity of the other. In the tables of experimental data compiled by the authors the factors are given which are most likely to effect electrolytic corrosion of buried pipes under practical conditions. Among these elements are current density of discharge, moisture content of the soil, presence of oxygen, temperature, voltage, etc. In the laboratory tests carefully cleaned iron anodes were tested in cans of sifted earth moistened with distilled water. Meanwhile check specimens of iron were also embedded in protected sections to investigate simple self-corrosion. Detailed precautions were necessary in the preparation and cleaning of the specimens. To afford a variety of practical conditions soils from various localities were used in the tests. The authors discussed briefly earth resistance, polarization and surface-film resistance, presenting tables of results of specific resistance and corrosion tests, etc. A number of practical conclusions were drawn from the experiments, it being found, among other facts, that corrosion is most efficient at low current densities and is independent of temperature, of depth of burial and of the oxygen present in electrolytes. Soil resistance varies with moisture content up to the point of saturation.

#### *Discussion*

Mr. J. L. R. Hayden commended the paper as a very valuable one, but expressed some disagreement respecting the passivity of iron.

Prof. D. C. Jackson remarked that the authors presented

only in part the results of the researches carried on at the Bureau of Standards. In his own experience he found that soil resistivity is a more important factor than moisture content. Thus corrosion differs greatly for the same voltages with different soil conditions, as found in different localities. Concrete road-bed construction usually holds much moisture and is thus conducting to a considerable degree. The effect of temperature is important, and frozen earth lessens the stray current flowing in metal structures beneath. In experiments made in 1894 he found corrosion in the presence of a single acid radical to be much less than that predicted by Faraday's law. Cast iron corrodes less rapidly than does wrought iron, perhaps due to the impeding action of the carbon and manganese present. When the earth around a pipe is frozen the conductivity is greatly reduced, which he found to be the case from the close agreement between actual and calculated current values required to thaw ice in water pipes. It is not the peak current in electrolysis which is important, but the average. The real problem now pressing for solution is how far to go to strike a cost balance between the damage done and the cost of preventing it.

Mr. H. T. Wreaks, of New York, N. Y., spoke of the efficacy of pipe coatings and asked what results had been obtained with them at the Bureau of Standards. Mr. H. V. Bozell, of Norman, Okla., referred to the expedient of laying water and gas mains on each side of the street, to avoid or reduce corrosion of the service pipes. Prof. F. C. Caldwell doubted the wisdom of placing a limit on track drop as some city authorities do, because of the implied acceptance of liability for damage by so doing.

Past-president H. G. Stott, of New York, spoke of the responsibility of railway companies, and mentioned the paper presented by Mr. G. I. Rhodes a few years ago on negative return feeder systems, which he characterized as a classic. The roads under his direction are using such means to reduce the damage to a minimum. Voltage is not so important a criterion as the points in the track return where the current is collected and returned to the power house.

Mr. A. Maxwell, of New York, commended the value of the paper. At very low current densities, of 0.0005 to 0.04 milliampere per sq. cm, the corrosion seems to exceed the theoretical amount.

Prof. A. F. Ganz said that the paper proves the practical value of Faraday's law, which gives about 20 lb. of iron lost per ampere-year. Very excessive apparent efficiencies of corrosion, as high as 500 per cent, were obtained by him only where the surface skin of the pipe had not been removed. Where the pipe had been turned off he found corrosion efficiencies of from about 100 to 120 per cent. There is unquestionably a variation of efficiency with the current density. But the damage increases where corrosive action is non-uniform and pitting occurs, and the pipe shell will be pierced much sooner than otherwise.

In closing the discussion Mr. Burton McCollum said that the passivity of iron is due to a number of different causes. For instance, it is passive in fuming nitric acid. He agreed that high earth resistance is an important point, but said that high resistance and low moisture content generally go together. Faraday's rule as originally stated is applicable only to the electrolyte, but it still holds also for the anode reaction. There is undoubtedly less leakage, he said, when the earth is frozen. It is not necessary to eliminate corrosion entirely, but only to reduce it to the economic maximum limit. Pipe coatings he did not in general approve of, as they are very likely through defects to augment corrosion at local points. Pitch, although expensive, he said, is an effective coating. Alternating-current electrolysis even at very low frequencies amounts to only a fraction of 1 per cent of the amount that occurs with direct current. He commended the use of return or negative feeders and said that insulated pipe joints are useful only as an adjunct remedy. In the matter of current densities he thought the range given in the paper covers average conditions, although possibly the lower limit ought to be depressed slightly.

### INDUSTRIAL EDUCATION

The report of the committee on education was prefaced with an introduction by Prof. H. H. Norris in which special reference was made to the work of the National Association of Corporation Schools, recently organized at New York. A detailed description of the purposes and plans of this association, prepared by Mr. F. C. Henderschott, followed as Part 2 of the report. "Vocational Education in Philadelphia and Vicinity," the section prepared by Mr. A. J. Rowland, described the work being done in the night and day schools of Drexel Institute, Franklin Institute, the Y. M. C. A., Temple University, Spring Garden Institute, the Philadelphia Trades School, the Pennsylvania Railroad Company's school of telegraphy, the Bell Telephone Company's plant schools, the electrical department of the Underwriters' Association, the School of Industrial Arts, etc. Western educational topics were taken up in the section by Mr. Robert Sibley, who gave an account of the work in A. I. E. E. sections and branches in the West and described the aims of some of the large utility companies of the Pacific slope. The Pennsylvania Railroad Company's apprentice schools were described in the closing section, prepared by Prof. J. P. Jackson and Mr. J. W. L. Hale.

#### *Discussion*

A prolonged and interesting discussion was contributed by Messrs. C. L. Clarke, New York; H. G. Stott, New York; M. T. Crawford, Seattle, Wash.; W. I. Slichter, New York; C. R. Dooley, East Pittsburgh; N. J. Neall, Boston; J. L. Wayne, Indianapolis; A. M. Buck, Urbana, Ill.; F. C. Caldwell, Columbus, Ohio; H. M. Friendly, Portland, Ore.; G. C. Shaad, Lawrence, Kan.; O. J. Ferguson, Lincoln, Neb.; C. A. Adams, Cambridge, Mass.; H. Barker, New York, and J. W. L. Hale, Altoona, Pa. The points brought out by these speakers are briefly summarized in the following paragraphs:

Ability to compose good English is one of the important things to impart in vocational training, and even college graduates are often sadly deficient in this respect. The keynote in industrial schools is not to develop ambition in the individual beyond his capabilities, which is sure to result in unhappiness, but to discover the occasional or perhaps rare man of unusual ability and promote him when fitted. The percentage of such men is very small. Another valuable feature of such training is equipping the industrial worker to do his work more efficiently and effectively, commencing with men in the lowest grade. Some apprenticeship courses, however, are open to the probable objection that their courses are too long and tend to wear out youthful material instead of developing it. There is need for stimulating and developing the worker's interest in his occupation. In selecting employees attention should be given to the local sentiment of the community toward education in general. Occasionally those workers who profess an interest in vocational training do so merely with the object of currying favor with their superiors. Vocational instructors should be men who can inspire their men; success in college work by no means forecasts success in this field. The real engineering must be done by college men, all of whom are needed because the supply is decreasing in the face of greater demand for them, ascribed in part to the competition of the agricultural college. There is great need of discovering the potential engineer of real ability before he makes a decision as to the work in life he thinks he is best fitted for. More attention should be paid to the reading of technical journals on the part of men who can be greatly helped in such a way. Many study engineering in college

who are not fitted for such work; perhaps one-half or two-thirds of all who now select such courses are unfitted for them. Too many men go to college for purely social reasons, and are inspired with false ambitions in directions which can never be realized.

### Non-elastic and Elastic Catenaries

In a paper by Messrs. C. A. Pierce, F. J. Adams and G. I. Gilchrest equations were derived for length of conductor, span, tension and sag based upon the assumption of a flexible elastic conductor. These equations contain functions of the angle of bending of the curve in which the conductor hangs, and a constant. The latter can be eliminated in two ways. The first leads to expressions for the characteristic ratios of elastic and non-elastic catenaries. The second method develops equations for the value of tension, conductor length and sag in terms of each other.

Numerical values of the characteristic ratios of the simple catenary are tabulated for angles less than 60 deg. These ratios are reduced to simple forms involving the non-elastic catenary, since the exact equations are too complicated to use. The results of tests on an experimental span approximately 200 ft. long are compared with the theoretical values based on the non-elastic catenary. Further experiments with wires of different sizes are now being carried on, and during the coming season it is planned to make tests of change of sag and tension with temperature.

### Commutating-Pole Saturation

Mr. Harold Stokes presented a paper in which was discussed the importance of obtaining the characteristic curve of the commutating-pole useful flux, especially with regard to machines designed to withstand heavy overloads. This curve must not depart from that of the flux required to neutralize the reactance volts of the machine by an amount greater than that which can be handled by the brush resistance. In addition to descriptions of methods for measuring the total and useful commutating-pole flux, results of tests on two machines are given. The author pointed out the importance of the ratio of leakage to useful flux at low saturations. Analysis was made of the magnetic leakages due to the main and commutating-pole ampere-turns, showing that the paths taken by the flux are to a degree dependent on the relative values of the pole ampere-turns. While the formula developed is subject to some discrepancies, the author's experience nevertheless has indicated sufficiently close agreement between calculated and test results to justify the approximate method.

#### *Discussion*

The commutating pole, said Mr. H. M. Hobart, has been of the greatest advantage in direct-current design. But when it was introduced designers rather overdid the matter. If there is any carelessness in the design there may be as much as from 200 to 300 per cent magnetic leakage. It is always best, the speaker said, to design the best possible machine of the ordinary type and then add enough commutating poles to neutralize the reactance voltage in the coils undergoing commutation. As a rule, such poles should not be as long as the full armature length. This device really serves best as the finishing touch in design.

Mr. F. D. Newbury said that the paper indicated a tendency among designers of direct-current machines to get down to fundamental considerations, following the lead of designers of alternating-current machines. The overload capacity is greatly improved by commutating poles, but even a compensated machine will flash with from fifteen to twenty times full-load current, or short-circuit. Mr. J. M. Hipple remarked that in the old style of design under-voltage and overload conditions are taken care of by stiffening the fields or saturating the pole tip. The commutating pole now provides a means of much improved operation under both of these conditions, limited only by saturation.

Mr. H. M. Hobart contended that the commutating pole is really an antidote in design, so to speak, and added that the cure may in some cases be worse than the disease. Against this view Mr. J. M. Hipple argued that the commutating pole is a prime condition in design, just as the use of a saturated pole-tip in the non-commutating-pole type is regarded. Mr. Harold Stokes in closing the discussion said that it is customary to limit the length of commutating poles to from 60 to 70 per cent of the armature length. Flashing over is due mainly to the fact that the flux in the commutating poles lags appreciably when very rapid changes occur.

### Motor Drive in the Rubber Industry

Information of interest to the industrial power engineer was given in a paper by Mr. C. A. Kelsey outlining the principal operations in the process of working up raw rubber. This material has a large capacity for absorbing power and is greatly improved by such working. Motor drive of sheet rolls involves an irregular load with abrupt peaks. Mixing, masticating, tubing, calendering, etc., are some of the other operations involving special applications of motors. Certain operations of "working" and mixing also have heavy overloads of short duration, but these diverse demands, by grouping under a single motor, result in reduced peaks. For individual drive squirrel-cage induction motors are preferable. In the calendering processes where close speed control over ranges of four to one is required direct-current motors may be used to advantage, speed adjustments being effected by the multi-voltage and adjustable-voltage methods. The tubers also require direct-current operation. As the power required to drive the mills is by far the greatest part of the total requirements, alternating-current service is generally selected. The motor-generator set or synchronous converter used to supply direct current can then be used for power-factor correction of the main circuit. In conclusion there was given a comparison of methods for obtaining adjustable-speed operation, with emphasis on the features to be embodied in the control.

### Operating Costs in Steam Plants

To avoid the variation in results which follows from lack of uniform accounting principles in power-plant determinations, Messrs. H. G. Stott and W. S. Gorsuch, in a paper entitled "Standardization of Method for Determining and Comparing Power Costs in Steam Plants," recommended the kilowatt-hour of net output as the fundamental basis for determining and comparing the cost of energy. Groups are suggested for assembling items of expense, and a method is proposed for providing an amortization fund from life-expectancy tables for replacing and renewing buildings and equipment. Administration expenses which are clearly departmental charges should be apportioned under the proper headings, the remainder being similarly divided on the basis of departmental costs. The relation between load-factor and cost of energy must be determined in order to permit the comparison of costs per kilowatt-hour under varying conditions. A method is also suggested for comparing the relative values of coals where the chemical analysis and price are different, and for correcting the cost of labor where the average daily wages per man are materially different.

#### *Discussion*

The discussion was opened by Mr. Henry Floy, New York City, who read a somewhat extended comment in which he characterized the paper as exceedingly important. On some of the points on the economics he differed from the authors. He said that some of the formulas did not include all of the cost and pointed out that some items of a general character, such as the salary of the president and other executive officers and the cost of the auditor's department, are very hard to distribute equitably to the dif-

ferent items in the detailed operating accounts. There is in the paper, declared the speaker, a deviation from standard accounting classifications, which would result in certain inconsistencies. The table of life expectancy for different kinds of plant equipment is not in accord with values generally accepted, in Mr. Floy's opinion. The exact dividing line between depreciation and maintenance is also very difficult to establish, he said, and likely to be arbitrary. In a very large system the speaker claimed that renewals can be treated as repairs, with no difficulty, but an annual check on depreciation is very desirable nevertheless. Mr. Floy also criticised the use of 5 per cent as an interest rate in computing the cost of capital, as being too low and not equal to the customary rate of return allowed on public-utility properties.

Mr. C. Schwartz, New York, read an extended discussion giving many figures and illustrations of the points involved in comparing operating costs in different plants and with dissimilar equipment. For several years past, he said, a number of large generating plants had been exchanging their cost data and found it very advantageous to do so. In one of these plants, having a rating of about 20,000 kw, the energy costs in several years had fallen from 0.67 cent to 0.45 cent per kw-hr., and if the turbine water rate had been down to 13 lb. the cost would have been reduced still further to 0.38 cent per kw-hr. It is needless, he thought, to go to the extreme of computing the cost per kw-hr. of each detailed item in the classification, but rather to do so only for the sub-totals. He also thought the wages per man per day do not give a useful figure for comparisons between plants using stokers and hand firing. Volatile matter, sulphur and other ingredients, said the speaker, are important factors in determining the true economic value of coal and should not be ignored as the authors had done. He also urged that the classification of costs given in the paper be simplified.

Dr. William McClellan, New York, said that while he first had many comments to offer, subsequent reflection reversed his intention and he was convinced that the paper was a masterpiece. He urged that the great importance of the subject warranted its reference to a special committee to consider it in detail, putting this in the form of a motion which was later seconded and carried. All companies, he said, ought to make such cost analyses, if only for their own information and advantage, but in any case the public service commissions will ultimately require them to do it. However, since there is considerable work involved in preparing the data, the companies will probably be divided into appropriate classes.

Mr. C. O. Mailloux then spoke briefly and, after highly commending the paper, seconded Dr. McClellan's formal motion that it be referred to the board of directors for subsequent reference at once to the proper Institute committee. Mr. P. Junkersfeld, Chicago, voiced his appreciation of the paper, but added that possibly it attempted too much. He said that the N. E. L. A. and the A. E. R. A. both have adopted accounting classifications, and compared their eight or nine principal sub-classes with the authors' classification.

The standardization of such a major classification, said the speaker, is almost imperative. Cost should be based always on net rather than gross output. He also thought it would be a very large undertaking to standardize all energy cost data over the entire country at one operation and recommended dividing the task in half, taking up operating costs first and capital or investment costs later, also condensing the classification into the simplest acceptable form at the outset. Load-factor, said Mr. Junkersfeld, ought always to be carefully defined, as the mere use of the term itself without qualification leads to misunderstanding. Spare plant equipment is another item, he said, which should be included; in some cases 10 per cent may suffice, while 20 per cent is hardly enough in others. Neither do maintenance and depreciation items always tell the whole story, because low maintenance costs may be reflected in poor physical condition of the plant, as in cases where the physical condition as a whole is on the decline instead of being kept up to normal.

Mr. D. B. Rushmore, Schenectady, N. Y., commended the paper highly and emphasized the growing importance of engineering economics in general. He also spoke of the importance of thoroughly investigating what the elements of cost really are and including them all in comparisons. Mr. A. H. Kruesi added his appreciation of the paper and recommended an extension of its classification to include plants selling steam for heating purposes. He also remarked that the load-factor does not completely define the load conditions, but there is needed in addition a plant-capacity factor. The use of curves instead of formulas, which he illustrated on the blackboard, he said would be a simpler method of analysis.

Prof. W. I. Slichter, New York, remarked that the terms power and energy were being confused and improperly used in an interchangeable sense. Mr. C. O. Mailloux remarked that abroad the term "energy transmission" is in general use, while in this country it is common practice to use the term "power transmission," with the same meaning. Prof. D. C. Jackson discussed the point at some length and said that even some textboooks on physics confound the terms power and energy. He then commended the paper as a classic, commenting upon the accuracy of the fourth-root rule in relation to the load-factor, as he had found from some analyses of his own. The cost of energy, he said, goes beyond the walls of the generating station and embraces the distribution, and hence the inspiring motive of the paper should be properly expanded to cover also the transportation and delivery of energy. He also made the point that insurance and depreciation have no relation, being quite apart and distinct. When a company has a sufficiently great number of property units, said the speaker, it can better afford to carry its own insurance.

Mr. R. D. Mershon said that power is a term in general use in referring to that which a central-station company sells to its customers, but in reality it is neither power nor energy, but service.

Mr. P. W. Sothman, New York, spoke very highly of the paper and emphasized again the need of properly defining and qualifying the term load-factor.

Mr. H. M. Hobart dwelt upon the effect of the load-factor and called attention to the difference between alternating-current and direct-current generating systems, where such questions come in with the former as power-factor and the number of phases in the electrical system. He also said that the difference between summer and winter temperatures gives rise to a large difference in maximum generator rating, amounting sometimes to one-half.

Mr. P. M. Lincoln stated that load factor is a generic term, but nevertheless agreed that in using it there is need for qualification.

In closing the discussion Mr. W. S. Gorsuch argued that investment costs, as well as operating expenses, must be included in a cost comparison in order to determine whether a plant is overloaded. The rule of the inverse fourth-root of the load-factor, he said, is applicable to small plants as well as large ones. The speaker then explained various points that had been raised in connection with the paper, offering the authors' justification for their position in the matter.

### AUTOMATIC SUBSTATIONS

In a paper by Mr. W. R. Summerhayes particular attention was devoted to the attendantless automatic rotary-converter substation of the Edison Electric Illuminating Company of Detroit, Mich., a more detailed account of which, with scheme of operation, etc., was given in these

columns last week. Various other automatic installations were also discussed, including train-lighting sets, motor drives, substations, etc., and a preliminary outline was given of the plans for installing a 1400-kw induction generator in a Western hydroelectric plant, to be operated at full gate-opening without a governor, while running in parallel with another station on the same stream. Elimination of the exciter greatly simplifies operation. An attendant's services will be required to shut down and start the machine, but in ordinary load-dispatching the unit will run idle during "valley" periods, at double rated speed, a condition for which its parts have been specially designed.

### Converter Substations in Basement

Within an area of less than a square mile of the business section of Chicago, ten substations aggregating 42,000 kw

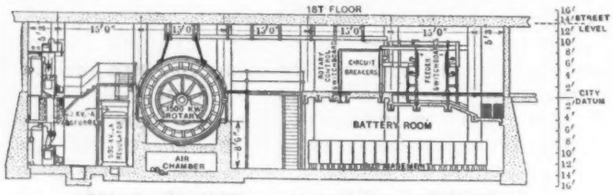



FIG. 3—SECTIONAL ELEVATION OF SUBSTATION

are in operation feeding energy into the direct-current three-wire system whose connected load is nearly 2,000,000 lamps. In a paper by Mr. B. G. Jamieson these substations were divided into two classes, the basement and sub-basement types. Methods and provisions for bringing in machinery were described. Air supply is a special problem in such plants, special air-cleaning and ventilating equipment being required. Stationary apparatus, such as transformers and regulators, is preferably cooled by water circulation. Other difficulties are introduced by the nature of the

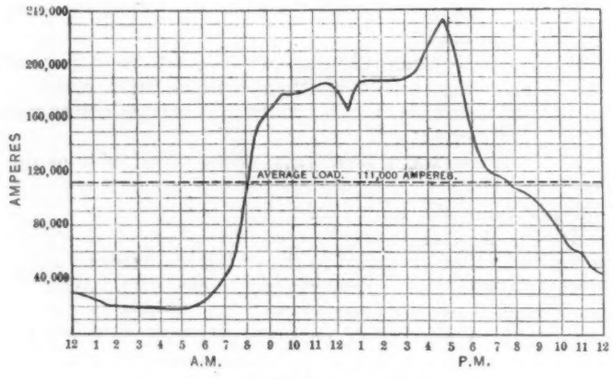



FIG. 4—DAILY LOAD CURVE

floor construction, which often interferes with foundationing, etc. The floor space needed for units of 500-kw capacity is 0.95 sq. ft. per kw and for 3500-kw units 0.54 sq. ft. per kw. With increasing values of real estate in large cities the basement type of substation, the author predicted, will become of increasing interest to electrical men.

### Operation of Frequency Changers

In a paper by Mr. N. E. Funk were discussed the general conditions governing parallel operation, including the theory, practical operation and methods of synchronizing two or more frequency changers tying together systems of different frequencies. After developing the theory of parallel operation, the results were applied to practical operating conditions, the aim being to aid the non-technical operator in automatically obtaining the correct conditions of synchronizing for all conditions of load. This is accomplished with the aid of synchroscope dial disks which have the machine-load markings entered on their scales at the proper angles. Great care is required in the design of frequency changers which are to transfer loads alternately from one frequency to another, for while it is possible that the load may be correctly divided at a given point when transferring load in one direction, the sets will not operate satisfactorily when the direction of load is reversed. Where, however, the sets are in different stations the line inductance controls to a large degree the division of the load.

### *Discussion*

Mr. D. B. Rushmore opened the discussion with comments upon the economic importance of substations in general and referred briefly to a small automatic substation designed by Mr. W. S. Moody and now in constant operation.

Mr. F. D. Newbury commented upon the ingenious solution of the problems in automatic substations described by the author, and said that it remains now to hear from operating men as to how the automatic substation holds up in service. There might be some difficulty, he thought, in bringing the converter up to synchronism with the proper polarity when supplied with excitation from a separate source. Possibly, said the speaker, it would be desirable to use only one starting voltage, instead of two or more. The need of a supply of clean air for cooling purposes is quite imperative. The speaker also asked whether oil pumps were in use anywhere to inject an oil film under the shaft bearings prior to starting, so as to reduce the initial torque required to overcome the friction of rest.

Prof. F. C. Caldwell, Columbus, Ohio, spoke briefly of a new automatic-resetting circuit-breaker which he said would soon be on the market. This device will automatically close after the load goes off.

Mr. P. M. Lincoln stated that the crux of the matter is how these substations behave in actual service.

Mr. H. M. Hobart spoke of the advantages of air-washing by means of water sprays instead of screens or filters. The largest installation of the former type, he said, is in the Deptford generating station in London. The spray both cools and washes the air, and, unlike filters, does not clog with accumulations of dirt and thus impair the quantity of supply and permit the machines to reach a higher temperature.

Mr. H. W. Peck declared he would not hesitate to apply automatic substations in central-station distribution. He also expressed the hope that Mr. Summerhayes would now turn his attention to the development of automatic stations for the operation of synchronous condensers and saw no reason to doubt the feasibility of the plan. It is now the best practice to have at least two attendants in substations where there is high-tension equipment, although one man could easily do the work. The introduction of automatic features will therefore be of great economic advantage.

In closing the discussion of his paper, Mr. Summerhayes said that although large converters are more reliable in operation than small ones, there will perhaps be some hesitation in adopting large automatic substations because of the investment risks involved. As regards the polarity of the converter when brought up to synchronism, he said that Mr. J. B. Taylor has devised a polarized relay for connection to the brushes which reverse the field circuit in case of wrong polarity. Replying to one of Mr. Newbury's comments, he thought it preferable to employ two starting voltages instead of one. The speaker also said that in his opinion synchronous condensers can be made automatic by means of Tirrill regulators. There is an instance, he said, where it is now planned to install an automatic restarter for a synchronous motor, to avoid shut-downs in the absence of the attendant who has other duties. Mr. Summerhayes reported that the operation of the Detroit installation thus far has been very satisfactory. The substation building in this case is not heated.

Mr. D. W. Roper, in closing the discussion on Mr. Jamieson's paper, said that air filters require less space than air washers, an important consideration where space economy is necessary.

In closing the remarks on his paper, Mr. Funk stated that on large machines an oil pressure in the bearings of about 300 lb. per sq. in. is required for a period of from three to five minutes in order to inject an oil film before starting. The sufficiency of the film is attested when the shaft lifts, giving as it does so an audible noise or sharp crack.

Owing to lack of space, as above noted, it has been necessary to omit from the foregoing abstracts and discussions of papers on the subjects of high-tension transmission, corona, and synchronous motors, which will appear in a later issue.

## Louisville Merger Company to Operate One Plant

General George H. Harries, president of the Louisville Lighting Company and of the newly organized Louisville Gas & Electric Company, formed by merging the Kentucky Electric Company with the Louisville companies, has announced that all of the various Louisville power plants will be operated for a time in order to determine which are the most efficient, while it will be some time before any concentration of production or distribution is determined upon. It is probable that the Kentucky Electric Company's plant, at Second and Washington Streets, will be the central distributing station for electricity, on account of its favorable location. Machinery now in use at the other plants will be moved to this plant, if the plan indicated is followed, and the generating units of the company's system will be concentrated there.

## Assessed Valuation and Rate-Making

Although the recent Supreme Court decisions in the Minnesota and Missouri rate cases, applying to transportation rates, are not of direct technical interest to the electrical industry, the comments of the court in the matter of correct methods of valuation of railway property for rate-making purposes are important. As will be remembered, the rates in question were upheld in a majority of the instances, but in certain exceptions were found confiscatory and therefore illegal under the Fourteenth Amendment to the United States Constitution. The ground upon which they were so found, however, was substantially that the roads were already so unprofitable, regardless of their value, that any further reduction of their revenues would constitute evident confiscation.

On the question of valuation in general the court held that the arbitrary method of applying some multiplier, such as two or three, to the assessed valuation for taxation purposes was wholly inadequate and inconclusive, even though it was the accepted practice in certain localities. The language of the court on this point was quoted as next given:

"Manifestly, a finding of confiscation could not be based on such a valuation in the absence of clear and convincing proof that the value actually existed and that the different items of property were estimated respectively by correct methods and in accordance with proper criteria of value. This proof was lacking.

"In the case of the other roads, although the special considerations which have been mentioned with respect to the Burlington property may not be applicable, still we are left in uncertainty as to the correctness of specific valuations which have been made. It cannot be regarded as sufficient to introduce assessments or valuations made for the purposes of taxation; and this is particularly true when the principles governing the assessments are not properly shown, and, for all that appears, they may have rested upon methods of appraisement which would be inadmissible in ascertaining the reasonable value of the property as a basis for charges to the public."

From this it would seem that, except in those cases where confiscation is self-evident, nothing short of a complete and thorough physical valuation would be admissible. These observations, although directly applicable to railroad transportation, doubtless apply also to any other public utility where the reasonableness of rates is in question. It is worthy of note that these decisions were delivered by Mr. Justice Hughes, who, when Governor of New York, was successful in his efforts to secure for the State a law regulating public utilities which has frequently been referred to as a most effective and efficient statute.

## Various Phases of Municipal Rate-Making Frankly Discussed

A meeting of the committee on gas, oil and electric light of the City Council of Chicago was held on June 26, primarily to discuss the report of City Electrician Palmer on the rate investigation of the Commonwealth Edison Company. Before adjournment, however, the discussion took a wider range and embraced a more general consideration of some aspects of municipal rate-making, brought out by vigorous colloquy between Alderman C. E. Merriam, a member of the committee, and Mr. William G. Beale, counsel for the Commonwealth Edison Company.

Early in the meeting Alderman Merriam questioned Mr. C. B. Willard, an expert accountant in the city comptroller's department, who assisted in the preparation of the report, about the alleged ownership of the Cosmopolitan Electric Company of Chicago by the Commonwealth Edison Company. Mr. Willard could give no definite information on this point, and Mr. William Arthur, of counsel for the Commonwealth Edison Company, said that he believed the Cosmopolitan Electric Company was an independent corporation. The relation of the Illinois Maintenance Company with the Commonwealth Edison Company was also discussed. It was shown that the former is an adjunct to the electric-service company, doing a steam-heating business.

The reading of Mr. Palmer's report was then resumed. The author explained that he found a surplus of $636,000 which might be applied to a reduction in rates. Mr. Palmer doubts if it is wise at this time to make a new appraisal. It would take four months, he said, merely to check the Byllesby appraisal of 1908.

### Mr. Beale Discusses the Palmer Report

Mr. Beale came in during the meeting. He told the committee very plainly that in his judgment as a lawyer the statute under which the city seeks to regulate the rates of the Commonwealth Edison Company is not valid. However, the company has voluntarily reduced its rates and will do so in the future when conditions warrant, despite the legal aspects of the case. The company is willing to discuss the subject with the committee.

Mr. Beale said that he recognized the spirit of fairness in which Mr. Palmer's report was made, but he objected to some features of it. In relation to the cost of street paving over conduits, which was excluded by Mr. Palmer, Mr. Beale pointed out that the Appellate Division of the Supreme Court of the State of New York has overruled Commissioner Maltbie of that State, who was quoted by Mr. Palmer as an authority sanctioning exclusion of paving costs in rate-making. No franchise value is allowed in the Palmer report, and Mr. Beale objected to this also. There should be, he said, an allowance for the value of the franchise. The company makes an annual payment to the city of 3 per cent of its gross receipts, and this indicates that the franchise has a value. The company in effect pays a rental for the use of the streets.

The practice of the Commonwealth Edison Company is extraordinarily conservative, according to its counsel. The cost of paving over conduits has been charged to operating expenses in pursuance of this policy. In any event the city has power to regulate maximum rates only. Inasmuch as about 25,000 customers produce no profit to the company, it is manifestly unjust to reduce the maximum rates. The company makes its profit from the larger users of electricity.

Mr. Beale declared that Mr. Palmer in his report virtually admitted that it would be unfair to require the company to reduce its maximum rates, and to prove this assertion quoted the following paragraph from page 105 of the Palmer printed report:

"It will be observed that the direct-current service is more costly than the alternating-current service, on account of greater investment and operating costs, due principally to conversion. For either class of service the present rate of 10 cents per kw-hr. for the first hour's daily use of the maximum demand, and 5 cents for the excess use, is greater than the cost, including an allowance of 7 per cent on the investment, when the maximum demand is used longer than about one and three-fourths hours per day. It is also evident that when the maximum is used less than about one and one-half hours per day, as an average, the company fails to realize 7 per cent on the required investment. Table No. 16 shows that about one-third of all retail lighting customers make use of their maximum not to exceed one hour per day, indicating that a large proportion are not profitable to the company when considered from their individual standpoint; yet if they did not employ the service, the cost of supply to those remaining would be increased."

### As to State Regulation

The subject of state regulation of public utilities in Illinois having been brought up, Mr. Beale said that so far as he knew no lawyer for a public-utility corporation had been asked to make a suggestion in relation to the bill providing for a state public utilities commission which passed the recent session of the Illinois Legislature. This bill, he said, has unsatisfactory features. If Mr. Beale had been asked, he could have pointed out some things that were unfair to the companies. The lawyer expressed himself as a firm believer in the city having the right to regulate local utilities, within limits.

Alderman Merriam made a speech in answer to Mr. Beale in which he said that the courts have not allowed franchise value to be capitalized for rate-making purposes. The alderman requested Mr. Beale to tell the committee why the Commonwealth Edison Company caused all its old books of account to be destroyed in 1911. This is a point brought up in Mr. Palmer's report, and one to which the daily newspapers of Chicago have devoted some attention.

### The Destruction of the Books in 1911

Answering Alderman Merriam, Mr. Beale said that the committee had no power to inquire into the disposal of the old books of the Commonwealth Edison Company. Ordinarily, he declared, when a man is exceedingly suspicious it may be taken as an indication that he is crooked himself. The directors of the Commonwealth Edison Company are men of high character, who will be acquitted of any improper action. The fact was that the Commonwealth Edison Company and its predecessors had bought up a large number of electric-service companies in the period from 1887 to 1911. These proceedings produced a great mass of books and papers of all kinds. After the consolidation of the Chicago Edison Company and the Commonwealth Electric Company the question arose whether there was any reason to preserve all these old books and papers. Mr. Insull asked Mr. Beale for his advice on this subject, and, after consideration, the lawyer advised the company that it had a perfect right to dispose of its old books. This course was taken, probably to save storage room, and that is all there is to the matter.

Alderman Merriam declared that Mr. Beale's remark about crookedness was a personal insult to himself, but nevertheless he would not be influenced by it in his course as a member of the committee. He said, however, that he thought Mr. Beale had shown discourtesy to the committee and he wanted the lawyer to know that he could not bulldoze the committee.

Mr. Beale disavowed any intention of browbeating the committee.

As to the ownership of the Cosmopolitan Electric Company, Mr. Beale said he thought that the Commonwealth Edison Company did not own that company, but that he was not sure. In any event he had no authority to give out information on the subject.

### Relation with Elevated-Railway Companies

In answer to another question of Alderman Merriam, Mr. Beale gave a frank exposition of the relation of the Commonwealth Edison Company to the trust or association which controls the elevated-railway properties of Chicago. He said that Mr. Insull, president of the Commonwealth Edison Company, was induced to take up the subject of consolidating the elevated properties in view of his company's relation to the transportation lines in supplying electrical energy to nearly all of them. However, the original effort failed. Some other gentlemen then took hold of the matter and asked Mr. Insull's company to come in with them. That proposition also came to naught. During the negotiations, and indeed up to the present time, there has never been the slightest idea of including the Commonwealth Edison Company in consolidation with the elevated railway companies. Finally, Mr. Henry A. Blair, of Chicago, took the matter up. He secured options from the principal stockholders to buy the elevated-railway properties of Chicago, after two or three years of effort. He then went to New York to get the money to finance the deal. Great difficulty was experienced in doing this. Finally the New York financiers asked the Commonwealth Edison Company to make a guaranty that the financiers would not lose anything if there was not a consolidation of the elevated and surface lines within a limited time. The amount of money required was $46,000,000 and the Commonwealth Edison Company was required to give its guaranty to the extent of $6,000,000. The guaranty was in the form of a stipulation that certain preferred stock should be repurchased by the Chicago trustees at a certain time and at a fixed price. When the Commonwealth Edison Company was asked to make this guaranty a threat was made that if it did not comply a large competing electric-service system would be built in Chicago. The required guaranty was made, and contracts for electric service were made or renewed with all the surface and elevated-railway companies of Chicago. Under these contracts the Commonwealth Edison Company expects to get a gross business of $100,000,000 within the next twenty-five years. This guaranty is the only relation which the Commonwealth Edison Company has to the consolidation of the elevated-railway companies of Chicago. To secure itself the Commonwealth Edison Company holds the stock of the trust or association which controls the elevated-railway companies. No doubt a reorganization of the elevated-railway companies will be brought about before long. The contract by which the Chicago trustees must buy back the preferred stock of the elevated railway companies, which contract has been guaranteed by the Commonwealth Edison Company, must be executed next year.

### Praise for the Commonwealth Edison Company

At the close of a rather stormy session Alderman Sitts, chairman of the committee, remarked that the Commonwealth Edison Company was one of the fairest corpora-

tions to do business with in the city of Chicago. It has set an example that other public-utility companies might well follow. Illustrating this, Alderman Sitts mentioned the negotiations which resulted in the Edison company obtaining the right-of-way for its elevated railway connecting the Chicago & Northwestern tracks with the Northwest generating station. The chairman hoped that no unpleasantness would result from the charges and counter-charges made during the meeting.

Mr. Beale declared smilingly that the committee took itself too seriously, but that the company was willing to discuss rate matters with its members as a matter of courtesy.

City Electrician Palmer defended his report in a few words. He said that Mr. Beale had not given the proper spirit of it in the extracts he had quoted.

## Massachusetts Legislation in 1913

The Massachusetts Legislature was prorogued on June 20, having passed 841 acts and resolves and considered more than 3000 matters in a session of about five and one-half months. Comparatively little direct legislation of immediate concern to electric or gas service companies was enacted, although many injurious and burdensome measures were presented to meet a timely death in committee or on the floor. A bill was passed rendering it unlawful for any person or company furnishing gas to consumers to charge a consumer for the use of a meter for any part of the fiscal year if the consumer during that period uses gas to the value of $7 or over. An act was passed requiring meters for electric-lighting service to indicate clearly the energy consumption in kw-hr., with a provision that no charge shall be made for the use of a lighting meter during any portion of twelve consecutive months if the consumer during that time uses electricity to the value of $9. The Legislature also enacted a law which provides that upon request of any member of the inspection department of the district police or of five employees of a factory or workshop, the state board of labor and industries shall investigate the adequacy of the shop lighting, with power to recommend changes, subject to a penalty of $500 for each failure to carry out an order of the board. This act is the outcome of serious neglect of the proper standards of industrial lighting in many installations and is generally regarded as a salutary measure.

The passage of the Washburn railroad bill, by which the former Board of Railroad Commissioners is to be increased to a total membership of five, with mandatory powers, under the title of the Massachusetts Public Service Commission, has already been noted in these columns. The act transfers the jurisdiction of the Highway Commission over telephone and telegraph companies to the new board, but leaves the present Gas and Electric Light Commission untouched in its duties and responsibilities. Easier facilities for raising capital for transportation companies' improvements are a feature of the act. Nothing was accomplished in the present session toward the electrification of railroads in the Boston district, but each year public sentiment grows stronger in favor of the abolition of the steam locomotive, and from all indications this radical change in motive power cannot long be delayed.

An important measure passed over the veto of Governor Foss late in the session authorizes the purchase by the New York, New Haven & Hartford Railroad through the Berkshire Street Railway of the trolley systems centering at Worcester and Springfield. With this purchase goes a provision that the railroad company shall make an early expenditure of $5,000,000 for new lines and facilities, notably in the hill-town district of western Massachusetts, which has been going backward industrially for many years through the absence of railroad or electric railway service. Another bill passed after a long struggle over the Governor's veto gives street railway motormen and conductors a nine-hour working day to be performed within eleven consecutive hours. A more socialistic measure has not been passed in Massachusetts within recent years, and it is anticipated that the constitutionality of the act will be tested in the courts in the near future, when many of its opponents think it will be declared illegal.

A number of important measures affecting the rapid-transit problem in the Greater Boston district also became law, among these being an act authorizing the construction by the Boston Transit Commission of a double-tracked subway between the North Station district in Boston and the Sullivan Square terminal in Charlestown, with the removal of the existing elevated structure on the route; an act providing for the construction of a subway for train service in the cities of Malden and Everett, in place of an elevated railway authorized by statute but not as yet constructed, and various investigations and reports to the next General Court by the commission. The jurisdiction of the Gas and Electric Light Commission has been extended to cover the complete and detailed investigation of the books and papers of all holding companies in control of stock of public utilities under the supervision of the board, and a special act provides that no holding company shall assume a title which will lead the public to consider it as a public-service corporation. An act was also passed providing for the publication through the secretary of state of the agreements of holding companies controlling public-service corporations. Another law forbids any corporation organized under the general law of the State to acquire more than 10 per cent of the stock of a public-service corporation, without special legislative authority.

## Public Service Commission News

### MASSACHUSETTS COMMISSION

Plans are being made for the reorganization of the Railroad Commission in accordance with the new Public Service Commission act. At the outset the board will take over all employees of the Highway Commission who have been engaged in the work of telephone supervision, and other enlargements of the organization will soon be made, with the formation of new departments headed by chiefs who have specialized in different branches. Chairman McLeod and Commissioner Bishop visited the New York commissions recently and studied the organization of both boards, the latter also making an inspection of the terminal facilities of the New York Central system at New York City. New quarters are being sought by the board for its offices.

### NEW YORK COMMISSIONS

The Public Service Commission of the First District will begin an inquiry July 7 to determine whether the New York Edison Company has violated an order made by the commission in December, 1908, prohibiting discrimination in rates and contracts by electrical corporations. The commission recently dismissed the complaint of Frankel Brothers alleging that the company refused to supply them with break-down service because they supplied energy from their private plant to another building which formerly was supplied by the Edison company. Frankel Brothers asked for a rehearing, but the commission denied the application. In it, however, the complainants alleged that the Edison company is supplying break-down service to the St. Nicholas Rink and Healey's Restaurant, where practically the same conditions exist as with Frankel Brothers and the building which they supplied. To ascertain whether the company is violating the commission's order in providing such service for the St. Nicholas Rink and Healy's Restaurant the commission ordered the inquiry.

# Current News Notes

Large Municipal Compensation.—The Commonwealth Edison Company of Chicago paid into the city treasury on June 17 the sum of $473,010.95. This amount represents 3 per cent of the gross receipts for the fiscal year ended May 31, 1913. The corresponding payment of last year was about $434,000. This percentage is required by the contract ordinance under which the company operates.

* * *

Field Day of Commonwealth Edison Section.—The fourth annual field day of the Commonwealth Edison Company Section of the N. E. L. A. in Chicago was held at the grounds of the Northwest station, Elston Avenue and Roscoe Street, on the afternoon of June 28. There was a pole-setting contest as well as a baseball game, tennis, trap-shooting and various running races. Prizes were given to the successful contestants.

* * *

Harnessing the Ohio with a Floating Power House.—The falls of the Ohio River at Louisville furnish perennial possibilities for the promoter. The latest scheme, which is broached by the National Power Company, of Birmingham, Ala., contemplates the location of a stationary barge or dock in midstream. Here energy would be developed by turbines mounted on the barge and connected to the shore to operate the generating equipment. Mr. S. F. Crecilius, a well-known engineer of Louisville; Mr. D. Edgar Macasco, and other business men of Birmingham are interested in the device, which has been tested at Joliet, Ill. The company is capitalized at $1,000,000, and it is said that $200,000 of the stock has been subscribed for. The proposed plant is to be located on the Indiana shore of the river, opposite Louisville.

* * *

Subway Situation in Chicago.—Negotiations continue between a sub-committee of the local transportation committee of the Chicago City Council and representatives of the elevated-railway companies of that city in relation to the building and operating of a subway. The plan now under consideration is for the city to build subways under the central business district, to cost about $17,000,000, out of the traction fund in the city treasury. It is reported that the railways have offered 4 per cent of the cost of construction for the privilege of using the subways. In making this offer Mr. W. G. Beale, counsel for the elevated railways, is reported to have said that a larger percentage could not be offered because the railway companies are contemplating the expenditure of $24,000,000 within the next ten years. The aldermen think that 4 per cent is an insufficient return for the city, inasmuch as the net return desired by the railway companies is 7 per cent.

* * *

Building Trades Strike in Chicago.—A strike, or "lockout," as it is variously termed, in Chicago has resulted in throwing about 20,000 men out of employment and bringing nearly all large building operations to a standstill throughout Cook County. The Building Construction Employers' Association seems to blame the International Brotherhood of Electrical Workers principally for the situation. It is said that this union insists that contractors employ "maintenance men," who are said to do no actual work but to receive $72 a week for being on duty eight hours a night. The maintenance men are supposed to be on hand in case something should go wrong with the electric hoists or with the electric lighting used in connection with the excavation of caissons. The regular pay of an electrical worker is $6 a day, and one set of maintenance men—those employed on the first shift—receive that pay. The work on the second shift is classed as overtime, for which double pay, or $12 a day, is required. The union is said to require maintenance men for every two electric hoists. The employers assert that the so-called "maintenance men" do no actual work, but receive enormous wages. They declare that the labor situation in Chicago has been for years conducted in an outrageously high-handed manner by the representatives of the unions. It is said that there probably has been no single day within the last three years when there was not some sort of a building strike in Chicago. On June 10 the maintenance men on the new building of the Continental and Commercial National Bank were laid off by the employers. The electricians struck on the following day and on June 12 all other building trades employed on the building struck in sympathy. Thereafter the strike spread to other buildings under construction. The contractors assert that they employ none but union men and pay the highest wages of any city in the country.

* * *

## SOCIETY MEETINGS

Boston Section, A. I. E. E.—At the recent business meeting of the Boston Section, American Institute of Electrical Engineers, the following officers were elected for the ensuing year: Chairman, Mr. N. J. Neall; vice-chairman, Dr. Harold Pender; secretary, Mr. L. L. Edgar; executive committee, Messrs. F. M. Gunby, G. K. Manson and T. L. Moreland.

* * *

Minnesota Electrical Contractors' Association.—At the fourteenth annual convention of the Minnesota Electrical Contractors' Association, held in Richfield, Minn., on June 16, officers were elected as follows: President, Mr. A. W. Zahm, Minneapolis; first vice-president, Mr. G. B. Burgess, Duluth; second vice-president, Mr. O. S. Bakke, Minneapolis; treasurer, Mr. C. T. Nimis, St. Paul; secretary and national director, Mr. G. M. Jones, Minneapolis. A banquet was given to the association in the evening at the Commercial Club in Minneapolis by the electrical supply dealers of St. Paul and Minneapolis.

* * *

Chicago Section of Illuminating Engineering Society.—The last meeting for the season of the Chicago Section of the Illuminating Engineering Society was held on June 27, with Mr. F. A. Vaughn, of Milwaukee, presiding. Officers were elected as follows: Chairman, Dr. M. G. Lloyd; secretary, Mr. J. B. Jackson; managers, Messrs. Nelson M. Black, J. W. Pfeifer, C. C. Schiller, M. J. Sturm and H. B. Wheeler. Mr. A. J. Sweet, of Milwaukee, discussed the subject of "Postal Car Illumination." Having been prominently connected with the tests on this subject under the auspices of the Baltimore & Ohio Railroad several months ago in Washington, D. C., Mr. Sweet is well qualified to speak with authority on the subject. Messrs. F. H. Bernhard, J. R. Cravath, F. A. Vaughn and A. J. Sweet took part in the general discussion which followed.

* * *

Electric Club of Chicago.—At the meeting of the Electric Club of Chicago on June 26 resolutions were adopted urging Congress to provide for a non-partisan patent commission made up of men of national reputation chosen from various walks of life. The resolutions also favor the creation of a court of patent appeals and strongly disapproved of House bill No. 23,417, commonly known as the "Oldfield bill." The resolutions were prepared by a committee consisting of Dr. M. G. Lloyd and Messrs. Donald M. Carter, H. M. Frantz, T. P. Gaylord, W. P. Hoagland, Eugene A. Rummler and Max W. Zabel. The club decided to have an outing some time during the summer. Mr. Frank Hedley, vice-president and general manager of the Interborough Rapid Transit Company, of New York, read a paper on "Transportation Facilities in New York." There will be no further meetings of the club until September.

# Electrical Equipment in Lytton Building

**Engine-room apparatus, refrigerating system, lighting installation and telephone and signal systems in an eighteen-story structure in Chicago**

THE new Lytton Building, at the northeast corner of South State Street and East Jackson Boulevard, Chicago, is an eighteen-story structure, with a basement and two sub-basements. The lower eight floors and the basements are occupied by The Hub department store, and the remaining floors are divided into offices, which will later be leased. Among the conveniences which electricity makes possible in this building are elevators, intercommunicating telephones between departments, automatic cash register system, dismissal, fire and burglar-alarm and auto-call bells, general illumination and emergency lighting, ventilation and tailor-shop equipment.

In the portion of the building occupied by The Hub about 145 kw is required for display lighting, 276 kw for general illumination, 26 kw for emergency lighting and 10 kw for miscellaneous illumination. In addition to the 138 kw required for indirect lighting in the offices above the eighth floor, wall plugs for about 17 kw have been installed. About 27 kw is required for exterior illumination. The total motor load is about 570 kw and the lighting load about 805 kw.

### Engine-Room Equipment

Although the building is already occupied, the engine room, which is located in the first sub-basement, was not completed at the time this was written, and electricity was being supplied by the Commonwealth Edison Company. The generating equipment which will eventually furnish electricity for the building consists of two 400-kw, 220-volt generators driven by two cross-compound Corliss engines, and one 150-kw generator driven by a Ball automatic engine. All of the generators were manufactured by the Crocker-Wheeler Company. As a three-wire distribution is used, two duplicate balancer sets are installed.

A Cuthbert switchboard, 96 in. high, consisting of black slate panels, 2 in. thick, is mounted on channel irons embedded in the concrete floor. No bracing from the walls or columns is required with this construction. The switchboard is subdivided into power, lighting, emergency, machine, feeder and balancer panels. Electrical energy supplied to The Hub and to the offices above the eighth floor is measured by four watt-hour meters which record total lamp, total motor, Hub lamp and Hub motor consumption. Weston ammeters of the flush type with illuminated dials are installed on the board. The feeder circuit-breakers are equipped with inverse-time-element, no-voltage and overload relays. In addition to these relays the machine circuit-breakers have reverse-power relays. Each generator panel is equipped with a pilot lamp placed behind a lens set flush with the switchboard. An additional machine panel was erected to take care of a generator which will be installed in the future. Ample space has been left in the generating room for the addition of 600 kw in generators. The balancer panels are equipped with motor-starting switches. The emergency lamps which light the hallways and fire exits and all lamps in the engine and boiler room are supplied with electricity from special feeders, which are tapped off from the machine buses before they reach the switches. This arrangement avoids almost any possible failure of the emergency lamps. A flat-ribbon grille incloses the back of the switchboard, entrance to which may be obtained at either end through doors having barrel locks. All of the connections between the generators and the switchboard are carried through iron conduit laid in the concrete floor.

### Refrigerating System

In addition to the generating equipment, there is an electrically driven 6-ton carbon-dioxide compression-type refrigerating plant in the first sub-basement which is used for cooling the drinking water. The compressor, which is a double-acting horizontal machine, was manufactured by Kroeschell Brothers Ice Machine Company. A 12.5-hp, 220-volt compound-wound direct-current Crocker-Wheeler

FIG. 1—LUMINOUS BOWL FIXTURES IN DEPARTMENT STORE

motor operating at 600 r.p.m. is belted to the compressor. The motor is equipped with a Cutler-Hammer motor-starter and regulator.

The water-cooling tank, 4 ft. in diameter and 5 ft. high, contains direct-expansion cooling coils, which consist of 1-in. extra-heavy iron pipes. The water is automatically maintained at a uniform level. The tank is insulated with

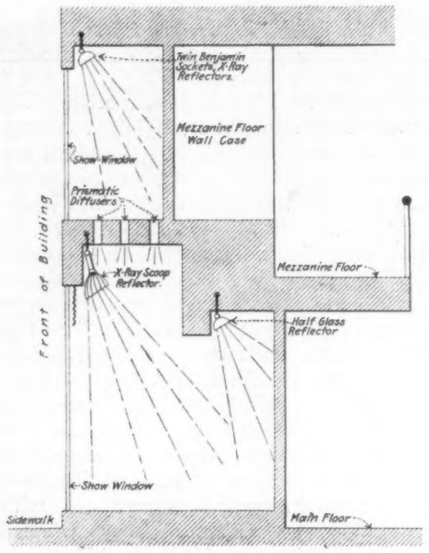



FIG. 2—DIAGRAM OF WINDOW-LIGHTING SCHEME

2 in. of cork board impregnated with hot asphalt, coated with cement and covered with canvas. Circulation of the drinking water through the system is maintained by a steam-operated duplex pump capable of delivering 15 gal. per minute.

### Boiler Room

The boiler room is conveniently located with relation to one of the Illinois Tunnel Company's tracks, so that coal may be brought in by tunnel cars or unloaded from the street above into manholes opening into the coal bunkers. Steam for heating the building and driving the engines is generated in three 500-hp boilers which are equipped with automatic stokers. The McKenzie chain grates installed are arranged to be driven by a single steam engine or by individual electric motors, the latter being preferable.

An overlapping bucket conveyor capable of delivering 25 tons of coal per hour carries the fuel from the bunkers located under the tunnel tracks to overhead bunkers which run parallel to the firing aisle. The same conveyor on its return route receives the ashes from under the grates and delivers them to an ash hopper. A 220-volt direct-current constant-speed motor equipped with a Cutler-Hammer motor starter operates the conveyor through a chain belt. Sheraduct conduit incloses the circuits connecting the motor with the switchboard.

Coal is fed to the stokers by an electrically operated overhead traveling discharger, which receives its supply of coal from the overhead bunkers. With this arrangement any particular bunker can be exhausted when the supply of coal shows indications of heating. A hot-water meter records all of the water supplied for boiler-feed purposes and the coal is weighed and recorded as it is supplied to the hoppers.

### Distributing Switchboard Room

From the switchboard feeder cables are carried through iron conduit laid in the floor to vertical shafts in diagonally opposite corners of the building. Communicating with these shafts on each floor are switch and fuse cabinets for general illumination. On the floors occupied by The Hub there are additional fuse cabinets for display lamps. With two exceptions the fuses and switches are installed in separate cabinets equipped with locks. The fuse cabinet, which is the larger in each case, is placed in the corridor, while the switch cabinet, which is much smaller because gang switches are used, is placed on the opposite side of the wall in the room containing the lamps which it controls.

### Tailor Shop

A special 110-volt riser is brought through one of the shafts to a fuse and switch cabinet in the tailor shop on the seventh floor. From this cabinet smaller feeders branch out to distributing centers located on columns and thence to the table switches. There are fifty-four tables in the tailor shop, some of which are used by tailors and some by pressers. Each table is lighted by two 60-watt tungsten lamps equipped with cone reflectors. No overhead wires are used, as all connections are brought up through the floor in condulet. Each of the pressers' tables is equipped with two and the tailors' tables with one 500-watt flatiron. The cord from each iron is supported by a ring which slides on a wire above the table. The switches for operating the irons are placed on the table. When they are turned on a pilot lamp over the table is lighted.

Several electric sewing machines are installed at present, and it is asserted that twenty-four will eventually be employed. On the same floor are nine fitting rooms, the lamps in which are operated by gang switches.

### Credit Telephones

The automatic National cash register system operated in conjunction with forty-eight credit telephones is used in this store. When purchasers desire credit the cashier in the department in which the sale is made calls up the credit department, which is located on the eighth floor, and at the same time inserts the bill of sale in an electrically operated stamping machine at the side of the telephone. Two telephone operators located in the credit department are supplied with a card-index system which enables them to quickly ascertain the status of the person desiring credit. If the purchaser is in good standing, the credit operator moves a lever which stamps the bill and its duplicate "O. K." The cash registers are operated by electricity.

### Signal and Call-Bell Systems

In the same room with the telephone operators is a device for ringing bells on all floors occupied by The Hub. All

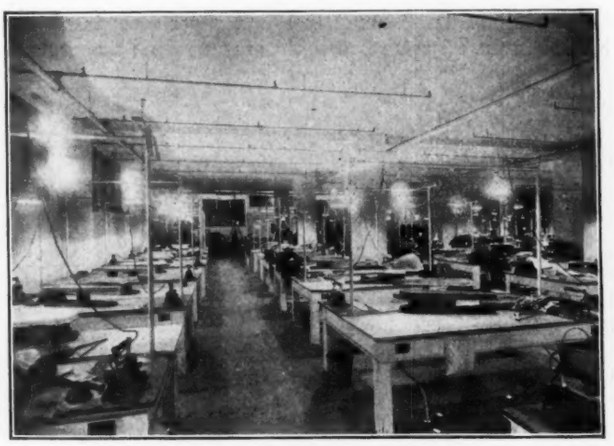


FIG. 3—ELECTRICALLY LIGHTED TAILOR SHOP

store officials have given call numbers, and when they cannot be reached by telephone the call bell is used to summon them. The ringing apparatus consists of a cylindrical contactor which is rotated by a motor and is designed to give thirty different ringing combinations. This contactor operates a relay by storage-battery energy, which in turn rings the 110-volt bell.

On every floor of the building there is a fire-alarm bell. A sprinkler system is installed throughout the building, and whenever a sprinkler head opens a fire alarm is turned in to the station and the bells ring on the floor where the trouble is located. A master switch rings the bells on all floors.

Dismissal bells are operated simultaneously from a master clock on the eighth floor. All possible entrances on the main floor and those near fire escapes on the upper floors are protected by burglar alarms. These send in alarms to police headquarters and indicate the point at which an attempt has been made to enter the building.

Chicago automatic intercommunicating telephones are used between departments and several outgoing lines are installed. The building is supplied with ten trunk lines on the Bell telephone system. Independent and Bell telephone booths are placed on each floor for the use of the patrons.

### DUMBWAITER ELEVATORS

To convey merchandise from the storerooms in the basement to floors on which the goods are retailed four electrically operated dumbwaiter elevators are installed. Two of these operate in one bank between the second sub-basement and the eighth floor. On each floor near the elevator shaft are a telephone and a push-button which connect with a switchboard located near the shaft on the seventh floor. This switchboard is operated by an attendant who has other duties which occupy his spare moments. On the switchboard are pilot lamps which indicate when the elevator is in motion and also when a door opening on to the shaft is not closed. An annunciator indicates the floors at which the elevator is desired and the one to which it is to be sent. A master controller causes the elevator to be sent to any predetermined floor. The apparatus is interlocked so that the elevator cannot be operated when any doors on the elevator shaft are open. The number of the floor to which the dumbwaiter is to be sent is conveyed to the elevator operator by pushing one of a group of push-buttons in the base of the elevator. The elevators are operated by two 10-hp compound-wound reversible motors. Slack cable attachments cause the elevator mechanism to stop when there is any obstruction in the shaft. Each elevator is capable of carrying 250 lb. and is automatically brought to a gradual stop.

Two additional dumbwaiters operate between the second sub-basement and the shoe department on the mezzanine

FIG. 4—COLLEGE ROOM IN LYTTON BUILDING

floor. These are automatic and no attendant is required to operate them. They are capable of carrying 150 lb. each. An electrically operated gearless-traction package elevator runs between the second sub-basement storeroom and the shipping room. In the shipping and delivery room are loud-speaking telephones, by means of which orders can be given out to the employees without their coming to the telephone.

### PASSENGER ELEVATORS

Two banks of electric passenger elevators are installed in the building. One bank of five elevators runs up to the eighth floor and is exclusively for patrons of The Hub. Another bank of six elevators is used for office service above the eighth floor. Each elevator is equipped with a loud-speaking receiver and a telephone, both of which con-

FIGS. 5 AND 6—INDIRECT-LIGHTING FIXTURES

nect with the starter on the main floor. With this equipment orders can be sent to the operator, and in case the elevator is stalled between floors the operator can notify the starter. Ricketts illuminated thresholds are used. The up-and-down flash signal system is employed for indicating elevator stops. An indicator showing the position of the elevator is located on the main floor only. The electric motors which operate the elevators are directly connected to driving drums and are of the overhead, commutating-pole type. A magnetic control switch in each car operates the 220-volt motors. Magnetic spring-actuated brakes are used to bring the car to a stop.

### LIGHTING

Before the scheme of illumination was finally decided upon experiments were conducted under actual service conditions to determine what form of lighting would give the most satisfactory results. Tests were run on direct, semi-direct and indirect fixtures with reflectors of eleven different types, special attention being paid to the color, shadows and distribution of the light. An experimental station was located on the third floor of the building, in a section 32 ft. long and 24 ft. wide, which was curtained off to give equal advantages to all systems. The tests were conducted by the Bryan-Marsh Electric Works of the General Electric Company. Data were obtained from six units of each system identically located and were submitted to Mr. Walter Lytton, general manager of the store, who passed upon the type of reflector to be used.

The fixtures on the first floor were designed by the Acme Chandelier Company, of Chicago, and those on the remaining floors were furnished by the Decorators' Supply Company, of the same city. All of the fixtures were designed to agree with the woodwork and showcases. Sixteen luminous-bowl semi-indirect fixtures equipped with eight 150-watt tungsten lamps with X-ray reflectors furnish the lighting for the main floor. These are supported by chains arranged so as to cast no shadows on the ceiling. Around the balcony on the mezzanine floor are pedestal indirect fixtures containing 150-watt lamps.

Most of the showcases have general illumination, and

when special emphasis is to be laid on any particular article a special lamp is so placed as to illuminate it. The showcase lamps are not controlled from a common switch cabinet, but each case has its individual switch.

The show windows are lighted by three rows of lamps, all of which are concealed from view. These are arranged to give cross lighting and thus to avoid any sharp contrasts. On the exterior of the fourth floor of the building are seventy-seven 100-watt border lamps, and on the sixteenth floor is an outside balcony on which thirty-two ornamental torches are erected having a total demand for 19,200 watts. Altogether about 15,000 tungsten lamps are used in the building.

### Ventilation

Seventeen electrically driven fans circulate fresh air through the entire building. The air is drawn in through screens and is passed through air washers, temperers and retemperers. The screens and washers remove the dust and impurities, and the temperers and retemperers heat the air and automatically maintain a uniform humidity. The air is

FIG. 7—SWITCHBOARD FOR OPERATING DUMB-WAITER ELEVATORS

delivered to two vertical air shafts and is distributed at each floor through ducts above show windows and wall showcases to registers.

Seven of the circulating fans are used for exhausting the foul air. They range in rating from 33,000 cu. ft. to 2000 cu. ft. per minute and are driven by 220-volt direct-current, variable-speed electric motors rated from 28 hp to 1.5 hp. The motors are directly connected in most cases, but chain drives are used in one or two cases. Cutler-Hammer starter and controllers mounted in locked cabinets are used with each fan and circulating pump. Air is delivered at about 75 deg. Fahr., and the humidity is maintained at about 55 per cent. Practically all of the motors in the building were furnished by the Crocker-Wheeler Company.

The Lytton Building was designed by Marshall & Fox, architects. Mr. A. B. Borden, representing Mr. Martin C. Schwab, the consulting engineer for The Hub, was the superintendent of construction. Mr. J. Graham Smith is the chief engineer of The Hub.

## Phase Compensation

By Val. A. Fynn

Phase compensation is the art of controlling the time-phase relation between two harmonic motions of same frequency, and more particularly between an alternating emf and an alternating current. One of the most useful purposes to which this art can be applied is to improve the power-factor of alternating-current motors.

For the purpose of gaining an insight into this art, it appears advisable first to review briefly the nature of a phase difference; then to ascertain some of its principal effects on the apparatus wherein it appears and on the source from which that apparatus is fed; to indicate how a phase difference is produced, and, finally, to show how a phase difference can be controlled in alternating-current motors and, more specifically, how the power-factor of a single-phase motor can be controlled.

A great many alternators, especially those with distributed armature windings, generate emfs which are very nearly harmonic, and the currents due to such emfs naturally tend to follow the same wave-shape. Discussions of alternating-current phenomena become sufficiently simple for practical purposes only when all emfs and currents are assumed to be truly harmonic. The conclusions derived on the basis of this assumption as a rule do not differ materially from the actual facts. This assumption is generally made, and it will be adopted throughout this paper.

A simple harmonic motion may be defined as the projection on any fixed straight line of a uniform circular motion. Uniform circular motion may be expressed by a vector of constant length, such as the radius of a circle revolving with constant speed about one of its extremities. Simple harmonic motion may be represented by another vector, which is the projection of the first vector on a fixed straight line. The first vector is referred to as a rotating vector, the second as an alternating vector. A rotating vector is constant in length but variable in direction; an alternating vector is variable in length but its direction is always along the same straight line.

If a vector such as $OE$ of Fig. 1 rotates at a uniform rate of $n$ revolutions per second about point $O$, say in the direction of the arrow $D$, then the projection $Oa$ of $OE$ on the fixed axis $Y$ is said to oscillate or alternate harmonically. An emf or a current is said to be harmonic when its instantaneous value is at each instant proportional to the vector $Oa$.

If the two harmonic motions of same period, depicted in Fig. 2 by the curves $e$ and $i$ respectively, represent the alternating emf impressed on a given apparatus and the alternating current taken by the same, then it is of interest to determine how much power can be developed by $e$ and $i$. This power, in watts, must, similarly to what obtains in the case of direct current, be equal at any instant to the product of the value of $e$ at that instant and the value of $i$ at the same instant. This product determines the instantaneous power absorbed by the apparatus in question and is shown in Fig. 2 by the curve marked "instantaneous power." It is seen that this instantaneous power varies greatly, being sometimes positive (full-line) and sometimes negative (dotted-line). The power developed by an alternating emf pulsates.

In practice it is seldom of interest to know the value of this instantaneous power, the important consideration generally being the average power during one complete cycle, that is, that which represents irrecoverable energy.

A cursory examination of Fig. 2 must show at once that the negative values of the instantaneous power must become smaller and smaller as the phase difference between the two factors $e$ and $i$ diminishes. When these two coincide in phase the instantaneous power curve will show no negative values at all and the average power will reach its maximum. Similarly, the negative values of the instantaneous

power will become greater and greater as the phase difference between the two factors $e$ and $i$ increases, reaching their maxima for a phase difference of 90 deg. between $e$ and $i$, as a simple graphical experiment will convince anyone sufficiently interested to try. With a phase difference of 90 deg. between $e$ and $i$ ($\theta = 90$ deg. in Fig. 1), it will be found that the instantaneous power $ei$ passes through identical sets of positive and negative values, and the average power is zero.

The same thing may be stated in a more definite manner, algebraically. In order to find an expression for the average value of $ei$, one may proceed as follows: The instantaneous values of emf and current, in terms of their maximum values, can be written as

$$ei = E.I. \sin \omega t. \sin (\omega t - \theta), \quad (1)$$

and since $\sin (\omega t - \theta) = \sin \omega t. \cos \theta - \cos \omega t. \sin \theta$

$$ei = E.I. (\sin^2 \omega t. \cos \theta - \sin \omega t. \cos \omega t. \sin \theta), \quad (2)$$

$$\text{or average } ei = E.I. (\cos \theta. \text{ Average } \sin^2 \omega t - \sin \theta. \text{ Average } \sin \omega t. \cos \omega t.) \quad (3)$$

But the average value of $(\sin \omega t. \cos \omega t)$ is zero, since it passes through identical sets of positive and negative values, while the average value of $(\sin^2 \omega t)$ is known to be one-half. Therefore, the last equation is reduced to:

$$\text{Average } e.i = \text{power} = \tfrac{1}{2} E.I. \cos \theta \quad (4)$$

or, substituting effective values, as measured by commercial instruments, for maximum values.

$$\text{Power} = \tfrac{1}{2}. \sqrt{2}. E. \sqrt{2}. I. \cos \theta$$

$$\text{Power} = E.I. \cos \theta \quad (5)$$

It is easily seen that this expression confirms the conclusions already reached to the effect that the average power is a maximum for phase coincidence between $e$ and $i$ and zero when there is a phase difference of 90 deg. between the two. The angle $\theta$ in equation (5) is the phase angle between $e$ and $i$, and, of course, between $E$ and $I$ of Figs. 1 and 2.

When there is a phase coincidence between the two, then $\theta$ is zero, and since the cosine of zero is unity, the power is equal to $(E \times I)$ just as is the case in direct-current practice.

When there is a phase difference of 90 deg. between $e$ and $i$—that is, when $\theta$ is 90 deg.—then the power is nil, irrespective of the magnitude of $E$ and $I$, because the cosine of 90 deg. is zero.

In Fig. 3 the percentage of power which can be developed by a given effective alternating emf and a given effective alternating current is plotted against the phase difference between the two, expressed in degrees. The power that can be developed by a constant emf equal in value to the above effective alternating emf, and by a constant current equal in value to the above effective alternating current, is taken as unity.

The factor $(\cos \theta)$, graphically shown in Fig. 3, depends on the resultant impedance of the circuit which is receiving the power, and this factor is known as the power-factor of the circuit.

A current may either lead the emf with which it is cooperating or it may lag behind the same. In either case the phase difference may amount to 90 deg. When the current leads the emf, one speaks of the circuit receiving the two as having a leading power-factor. When the current lags behind the emf, the circuit is referred to as having a lagging power-factor. When the current coincides in phase with the emf, the circuit is spoken of as one having a unity power-factor.

It is only in a circuit having unity power-factor that a given alternating emf and a given alternating current can perform the maximum amount of work.

A leading current in a transmission line, a cable or the like occasions just as much loss as a corresponding lagging current, but all the ill effects of a lagging current in a conductor can be absolutely avoided or compensated for by sending through that same conductor an equal but leading current, and vice versa.

Since a great proportion of alternating-current apparatus already in operation takes lagging currents, it is obviously of great commercial importance to employ means by which at least some of this apparatus may be so constituted as to operate with leading power-factor over at least part of its working range. Leading power-factor as compared with unity power-factor apparatus will, however, require a greater real as well as apparent input for the same useful work done. It follows that such apparatus must be either larger or less efficient than unity power-factor apparatus.

A circuit in which the current leads the emf by $a$ degrees generally utilizes a given alternating emf and a given alternating current almost as inefficiently, in producing work, as a circuit in which the current lags behind the emf by the same angle $a$.

A lagging alternating current drawn from a generator affects the latter in three ways: It decreases the efficiency of the generator because of the greater excitation required to maintain a constant terminal voltage for a given current output, and also because of the decreased real output for a given current at a given terminal voltage. It furthermore increases the terminal voltage drop for a given current at constant excitation; in other words, makes the self-regulating properties of the generator worse.

A leading current also decreases the real output of an alternator, but decreases instead of increasing the amount of excitation required by the latter with diminishing power-factor, with the result that the efficiency is not decreased to quite the same extent as by a lagging current. Since a leading current decreases the amount of excitation required by a generator, it tends to improve the self-regulating properties of the latter, instead of making them worse, but is, of course, liable to overshoot the mark if the lead becomes very marked.

A lagging current withdrawn from a generator proportioned for a maximum output of 100 kw precludes the full utilization of the prime mover, for the reason that an apparent output of 100 kva will always heat the machine more than a real output of 100 kw. The heating of the generator will be the greater the smaller the power-factor of the circuit to which it feeds energy, because the excitation losses increase with decreasing power-factor, while the armature copper losses remain the same so long as the current is the same, the heating effect of a current being independent of the phase relation it bears to its emf. But the poorer the power-factor the smaller the real or kilowatt output and therefore the smaller the load on the prime mover. To increase the load on the prime mover to the value at which it will operate most economically is out of the question, because the heating of the generator will not allow one to do so. Nothing can be done but to use an alternator which operates below its full rated output on a unity power-factor load, its output being then limited by the prime mover, or to use a prime mover operating below its full rated output on loads with a power-factor differing from unity, its output being then limited by the heating of the generator.

A leading current withdrawn from a generator also precludes the full utilization of the prime mover, but not quite to such an extent as in the case of a lagging current, for the reason that a leading current does not require an increase but a decrease of excitation with increasing lead.

The best results are obtained from a given generator and prime mover of equal rating when the current withdrawn from the former leads the terminal emf by a few degrees. To achieve this most desirable object it is necessary to utilize alternating-current apparatus capable of being so adjusted as to absorb leading currents.

It has been shown that lagging or leading currents are detrimental to the line, to the generators and to the prime movers, and it has been suggested that current-consuming devices are desirable which operate with leading power-

factor, for the purpose of compensating as much as possible for the lagging currents which are present in all existing alternating-current distribution systems. It thus becomes specially interesting to form a clear idea as to the ability of such apparatus to perform simultaneously useful work besides that of compensating for the deficiencies of other apparatus fed from the same distributing system.

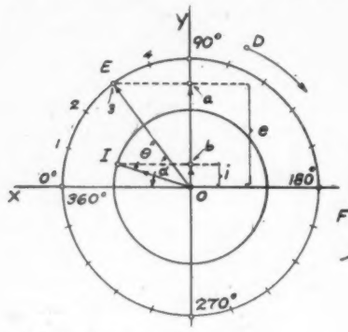



Fig. 1

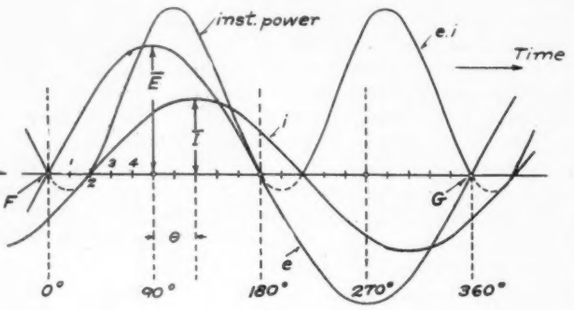



Fig. 2

FIGS. 1 AND 2—GRAPHIC REPRESENTATION OF TWO HARMONIC MOTIONS AND OF THEIR PRODUCT AT EACH INSTANT

To this end consider, say, a unity-power-factor single-phase motor designed for a normal input of 1000 watts, or, say, 20 effective amperes at 50 effective volts, disregard all losses except those due to ohmic resistance, and assume that with 1000 watts input at power-factor unity (see Fig. 4) these ohmic losses amount to 50 watts, or 5 per cent. For a power-factor of unity the machine will, therefore, absorb 1000 watts; 50 watts of that power will be wasted in heating the copper in the machine, while 950 watts will be available for translation or conversion into mechanical power.

Now change the constitution of the machine so as to cause it to operate with a phase difference $\theta$ differing from zero, but do not alter its ohmic resistance. In order to secure the same output—that is, to make the same amount of mechanical power available at the motor shaft—the input will have to be considerably increased, for a reason clearly apparent from a comparison of Figs. 4 and 5. In Fig. 4, which depicts the unity-power-factor condition, the total current $I$ is in phase with the emf $E$, and all of it is useful. If the machine is to operate with a phase difference $\theta$ between $E$ and $I$ and yield the same output as before, then the useful component of $I$, or its projection $I_1$ on $E$, must have the same magnitude as had the total current $I$ for the case of unity power-factor, when $\theta$ was zero. Fig. 5 clearly shows that for constant output the total current $I$ must increase rapidly with increasing $\theta$; that is, with decreasing power-factor.

Whenever the total current taken by a translating device does not coincide with the terminal emf, that current can be conveniently resolved into two components, one of which coincides with the emf while the other is in time quadrature to it. The former, $I_1$, is that which is proportional to the power available and is known as the watt or useful current component, while the latter $I_2$ only wastes energy and is referred to as the wattless or idle component. In Fig. 6 the resultant $I$ and its two components $I_1$ and $I_2$ are plotted against cos $\theta$ and the corresponding angle $\theta$ for the case of constant motor output. While $I_1$ remains constant, both $I_2$ and $I$ increase at a rapid rate, particularly for the smaller values of cos $\theta$. In view of this very rapid increase of the idle component $I_2$ the ohmic losses $(I_1^2 + I_2^2)\,R$ increase most rapidly and for a phase angle of about 77 deg. these losses alone amount to the total input into this motor when it operates at unity power-factor. The larger total current required by the motor with decreasing power-factor of course necessitates a higher terminal voltage, so that while the output remains constant, both the real and the apparent input increase very rapidly.

Fig. 6 shows conclusively that the highest efficiency of an apparatus of any kind is attained for unity power-factor, but that the efficiency does not vary greatly in the neighborhood of $\theta = 0$. Since Fig. 6 holds equally true for lagging and leading power-factor, it will be clear that a motor designed to operate with a leading power-factor at full-load will have a lower efficiency than one designed to operate at unity power-factor, unless the leading power-factor machine is made sufficiently larger to take care of the increased losses. A larger machine must of course be a more expensive one. From the economical point of view, a motor operating under anything like full load should not be called upon to supply a leading current component to the mains, but it can reasonably be expected to do so, to a limited extent, at light loads. Any exaggeration of this leading power-factor feature inevitably leads to a decreased efficiency, unless the active material of the machine is increased beyond the normal.

The one rational thing for a central station to do is to use unity-power-factor motors only—that is, machines which operate under all loads with a power-factor in the immediate neighborhood of unity. Existing undertakings already supplying energy to many motors of the non-compensated type, must help themselves by insisting that all new motors connected to their mains shall operate with an appreciably leading power-factor, at least over part of their range of operation. The leading current taken by these over-compensated motors will then compensate for the lagging current taken by the existing non-compensated machines. Since the compensating capacity of any one leading-power-factor motor is necessarily limited, the average power-factor of a central station can only be materially improved by the addition of many such motors. These over-compensated motors will be called upon to perform two duties, namely, to compensate for the shortcomings of

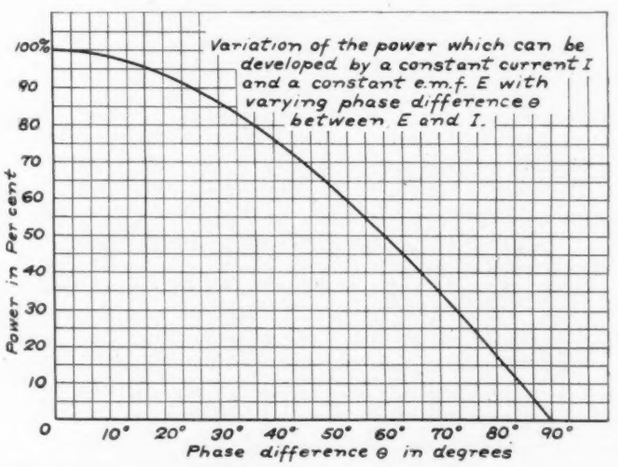



FIG. 3—RELATION OF KILOWATTS TO KILOVOLT-AMPERES WITH VARYING POWER-FACTOR

the existing machines by acting as condensers and to convert electrical energy into mechanical work. Besides serving their owner in the usual way, they will be greatly benefiting the station engineer by raising his average power-factor. The introduction of these machines in the greatest possible number should therefore be facilitated in every way by all station engineers. Machines designed to operate

with a leading no-load and a nearly unity full-load power-factor are ideal from the point of view of the station engineer and the consumer and acceptable to the manufacturer.

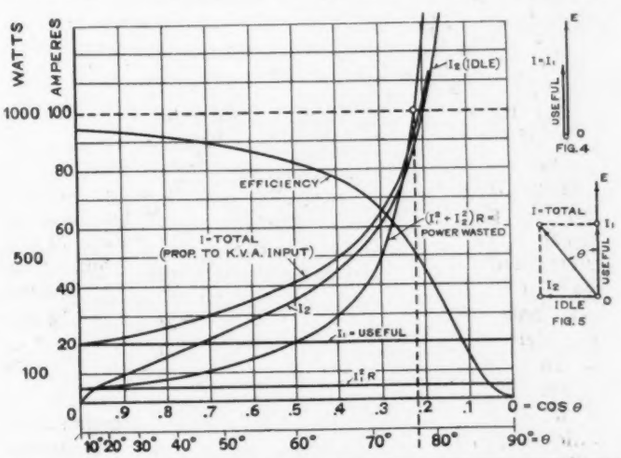
In practice, polyphase as well as single-phase induction motors of ordinary construction are the chief offenders in lowering the average power-factor of a station. The power-factor of ordinary single-phase induction motors, for instance, varies from about 0.1 at no-load to 0.6 at full load in the smaller sizes, the full-load power-factor rising to about 0.85 in the larger motors. A station supplying energy to many small motors may easily have to deal with an average power-factor of about 50 per cent, while one serving a greater proportion of large motors may, under favorable circumstances, have an average power-factor which is as high as 70 per cent.

A reference to Fig. 6 will show that the first of the above stations is called upon to supply 175 amp of idle current for every 100 amp of useful current, while the second must generate 110 idle amp for every 100 useful amp. All copper losses in the first station are four times as great as if its average power-factor were unity, while the copper losses in the second station exceed the unity-power-factor losses by 110 per cent.

All these considerations show that the station engineer directing a long-established undertaking has every inducement to favor reasonably overcompensated motors. But even if he makes it a rule not to countenance the use on his mains of any motor showing a no-load lagging power-factor inferior to 85 per cent, all his troubles will very soon assume unimportant proportions. New electric service companies should avoid trouble from the start by allowing nothing but unity power-factor motors on their mains.

## SECTION II

In order to maintain a certain current through a non-inductive or ohmic circuit, an emf is required which is of the same phase as the current. This statement is strictly true for direct as well as for alternating current. The reason why larger and phase-displaced emfs are necessary to maintain the same current in an inductive or in a capacity circuit is found in the fact that the rapidly varying currents produce phenomena which are not produced by steady continuous currents. Alternating currents are responsible, within the circuit in which they flow, for emfs other than




FIGS. 4, 5 AND 6—INCREASE OF IDLE CURRENT FOR CONSTANT OUTPUT WITH DECREASING POWER-FACTOR AND ITS EFFECT ON EFFICIENCY

those due to ohmic resistance. The phase relation between these additional emfs and the current in the circuit determines the phase relation between the terminal emf. and the current, but that emf which actually forces the current through the ohmic resistance of the circuit, and which is, at least, a component of the terminal emf, always remains co-phasal with the current.

As is well known, inductance or capacity contained in a circuit on which an alternating emf is impressed can produce a phase difference between said emf and the current through the circuit. There are other causes which lead to phase differences, and one of the most important of these may best be studied by analyzing the mode of operation of an ordinary synchronous single-phase or polyphase motor.

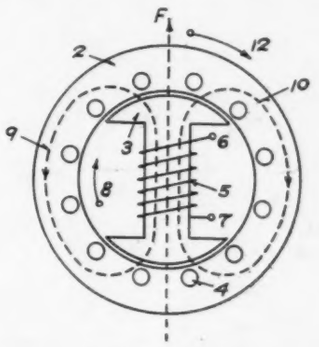



FIG. 7—ALTERNATING-CURRENT GENERATOR

The study of this machine also reveals the principle on which rests the method of phase compensation employed by the Wagner Electric Manufacturing Company.

Consider first an alternate-current generator of ordinary construction such as is diagrammatically shown in Fig. 7. This machine comprises a stator, 2, provided with a number of slots, 4, wherein are located the armature coils. These coils are not shown in Fig. 7, their arrangement for single-phase as well as polyphase alternators being well understood and having no influence on the conclusions about to be drawn. Arranged to rotate within the armature, 2, is a field magnet, 3, provided with an exciting winding, 5, adapted to receive a unidirectional exciting current which may be introduced by means of slip-rings at the points 6 and 7. As long as the field magnet, 3, is stationary, the magnetic flux produced by the exciting winding, 5, will be mainly distributed along the dotted lines 9 and 10. It is usual and convenient to represent a flux distributed as shown by these lines simply by means of a straight line, such as $F$, indicating the general direction of that flux This method of representation will be used hereafter and a line such as $F$ will be understood to represent the flux distribution shown in Fig. 7, or an equivalent flux distribution. As long as the field magnet, 3, is stationary and the exciting current sent into 5 is constant, no emfs will be produced in the armature windings located in the slots 4; the flux picture shown in Fig. 7 will be stationary in space and the magnitude of this flux will be constant. If the field magnet is revolved, say in a clockwise direction, as indicated by the arrow, 8, then the flux picture will not materially change its shape or its magnitude, but will revolve with the field magnet, 3, in the direction 12, which, of course, must coincide with the direction 8 in which the field magnet revolves. Under these conditions, the flux will cut the armature conductors and one or more emfs will be generated in the latter. The alternator is now in a position to convert mechanical into electrical energy.

In order to produce an alternator it is therefore necessary to dispose of an armature provided with the necessary windings, of a unidirectional magnetic flux (of adjustable magnitude), and to arrange for a relative motion between the armature windings and the magnetic flux. It is, of course, immaterial whether the armature conductors are kept stationary and the flux is revolved or vice versa.

Assume now that a three-phase alternator of the type shown in Fig. 7 is driven at a constant speed and is feeding a unity power-factor circuit. Polyphase currents circulating in the armature will produce, in a manner well understood, a unidirectional, synchronously revolving field

the magnitude of which depends on the magnitude of the polyphase currents and the direction of rotation of which is the same as the direction of rotation of the unidirectional exciting flux produced in the field magnet, 3, and responsible for the polyphase currents in the armature. This revolving field produced by the armature currents is termed "armature reaction," and, for unity power-factor, corresponds exactly to the armature reaction of an ordinary direct-current generator. In a direct-current generator of ordinary construction this armature reaction is stationary in space and displaced by 90 deg. with respect to the field or exciting flux. If a direct-current generator were built with a stationary instead of a revolving armature, and with a revolving exciting field instead of a stationary one, then it would require revolving armature brushes instead of stationary brushes, and while the armature reaction flux would still maintain its angular displacement of 90 deg. with respect to the exciting flux, it would now revolve at the same speed as the latter.

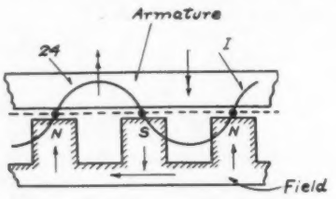



FIG. 8—GENERATOR FEEDING UNITY-POWER-FACTOR CIRCUIT —SPACE RELATION OF ARMATURE REACTION FLUX TO EXCITING FLUX

Returning to the case of a polyphase alternator feeding energy to a unity power-factor circuit, it is seen at once that the flux produced by the armature reaction of such an alternator, under the conditions named, must be displaced in space by 90 deg. with respect to the exciting flux. If the armature windings of a multipolar alternator are well distributed over the air-gap periphery, then the armature reaction of such a machine can clearly be represented by a synchronously rotating wave of magnetic flux, such as is diagrammatically indicated by the curve 24 of Fig. 8. Remembering that the armature reaction and the exciting flux always revolve at the same speed and in the same direction, it is at once seen that the influence of the one on the other may just as well be ascertained from their stationary images. Now, since for unity power-factor the armature reaction flux is displaced by 90 deg. with respect to the exciting flux, then the maxima of the former will coincide with the minima of the latter; in other words, the maxima of the armature reaction flux will appear between adjacent poles of the field magnet, as shown in Fig. 8. For a direction of rotation of the field magnet from right to left, the positive maximum of the armature reaction flux will fall ahead of the negative maximum of the field magnet; in other words, a north pole of the armature reaction flux will precede a south pole of the exciting flux. In all the figures the direction of the exciting flux is indicated by single-head arrows, while the direction of the armature reaction flux is shown by double-head arrows, and it appears that for the case of unity power-factor the armature reaction flux can only distort the exciting flux, but cannot (for the case of an ideal machine) alter the magnitude of this flux, because the north and south polarities overlap to the extent of half a pole pitch. The magnitude of the armature reaction flux, of course, depends on the ampere load and increases as the load increases, while the exciting flux depends on the unidirectional exciting current sent into the field winding, 5, and remains constant as long as that current is constant. A change in the magnitude of either flux is without effect on the above conclusions.

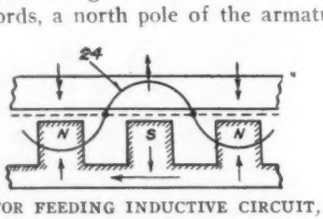



FIG. 9—GENERATOR FEEDING INDUCTIVE CIRCUIT, 90-DEG. LAG —SPACE RELATION OF ARMATURE REACTION FLUX TO EXCITING FLUX

Next consider the alternator in question operating on a circuit containing pure inductance and therefore possessed of what is called a "lagging" power-factor. In this case the alternating current will lag behind the alternating emf by 90 deg. in time, with the result that the armature reaction flux, which revolves at the same speed as the exciting flux, will be permanently retarded by 90 space-degrees relatively to this exciting flux. The reason for this displacement arises from the fact that the time-phase of the emf generated in any given armature conductor is at any instant dependent on the space position of this conductor at that instant relatively to a given field pole. From this it follows that if the current conveyed by the conductor in question is in time-phase with the emf generated therein, then the maximum value of that current, of the emf to which it is due and of the reaction flux set up by the current will all coincide in time and will all bear, at any given instant, the same space relation to a given field pole. But it also follows that when the current and the reaction flux differ in time-phase from the generated emf, then the space position of the maximum value of the reaction flux relatively to a given field pole will differ correspondingly from the space position of the maximum value of the generated emf relatively to the same field pole. This being true for the reaction flux due to any one conductor must also be true for the reaction flux set up by all the conductors and indicated by curve 24 or *I* of Figs. 8, 9 and 10. The space position of the reaction flux relatively to the exciting flux, which corresponds to a lagging current of 90 deg., is shown in Fig. 9, from which it is apparent that the positive maximum of the armature reaction flux has been shifted back through 90 deg.—that is, against the mutual direction of rotation of the armature reaction flux and of the exciting flux. A glance at this figure discloses the fact that the armature reaction flux now opposes the exciting flux at every point, with the result that the resultant flux of the machine—that is, that on which the terminal emf depends —is considerably weakened. It is seen that a lagging current delivered by an alternator produces an armature reaction which demagnetizes the exciting field of that machine.

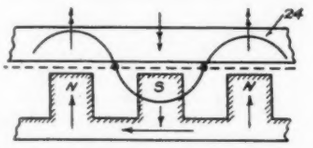
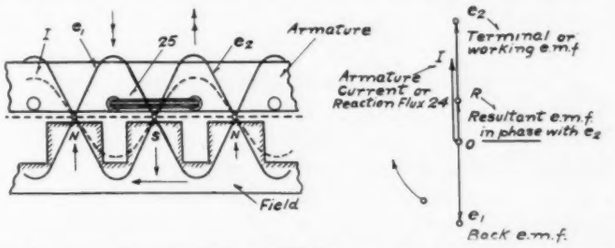



FIG. 10—GENERATOR FEEDING CAPACITY CIRCUIT, 90-DEG. LEAD—SPACE RELATION OF ARMATURE FLUX TO EXCITING FLUX

In case the alternator operates on a circuit having a so-called "leading" power-factor, the armature reaction flux will be moved out of its neutral position corresponding to unity power-factor and propelled in a forward direction to an extent depending on the power-factor of the circuit. If the current delivered by the alternator leads the alternating emf by 90 time deg., then the armature reaction flux will be moved forward through 90 space deg. and will occupy, relatively to the exciting flux, the position shown by the curve 24 in Fig. 10. This figure shows that the armature reaction flux produced by a leading current helps, or adds to, the magnetization produced by the exciting flux.

It is easy to show that exactly the same conditions prevail in the case of a single-phase alternator. It is true that the armature reaction of a single-phase alternator does not produce a revolving field of constant magnitude, in the sense in which this term was used in connection with the polyphase machine. In fact, the total armature reaction of a single-phase machine gives rise to a simple alternating or oscillating flux wave; an alternating flux can always be decomposed into two unidirectional component revolving fields of one-half the amplitude of the alternating field, on condition that it be assumed that one of these fields revolves synchronously in one direction while the other revolves with equal speed in the opposite direction. In the case of an alternator, the speed of revolution of each of these components is the same as that of the exciting field, and since these components revolve in opposite directions, it is clear that the direction in which one of them revolves will coincide with the direction of rotation of the exciting field while the other will be opposed to that direction. That unidirectional armature reaction flux component which revolves in the same direction as the exciting field will react on the latter in exactly the same manner as the unidirectional revolving armature flux of a polyphase machine. Since the other unidirectional revolving component of that single-phase armature reaction flux revolves at the same speed as the exciting flux, but in a direction opposed to it, then the relative speed of these two fluxes must be double the synchronous, and the effect of this second component on the exciting flux is nil, since it alternates from a magnetizing to a demagnetizing action as it sweeps past each pole.




FIGS. 11 AND 12—SYNCHRONOUS MOTOR EXCITED TO TAKE CURRENT IN PHASE WITH TERMINAL EMF—SPACE AND PHASE RELATION OF EXCITING FLUX TO WORKING EMF, BACK EMF AND ARMATURE REACTION FLUX

This component merely increases the losses in the machine.

Reviewing the results arrived at so far we find:

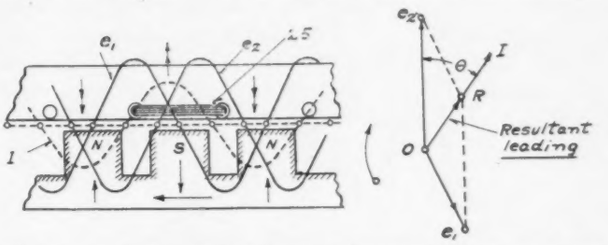
(1) That in order to produce an alternator there must be provided, in one way or another, a unidirectional exciting flux (of adjustable magnitude) revolving relatively to a fixed armature, or vice versa.

(2) If an alternator delivers current which is in time-phase with the terminal emf, then the armature reaction does not affect the magnitude of the exciting flux nor that of the generated voltage, but merely distorts the exciting flux.

(3) In case the armature delivers current lagging behind the terminal emf, the armature reaction weakens the exciting flux and tends to lower the generated voltage.

(4) In case the armature delivers current leading the terminal emf, the armature reaction strengthens the exciting flux and tends to raise the generated voltage.

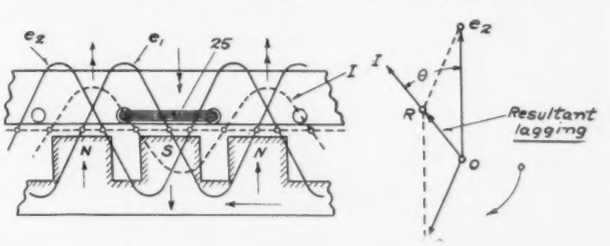
Now suppose the alternator to be running as a motor, its armature being connected to an alternating-current supply and its shaft driving any desired power-consuming device, such as a pump, which cannot possibly drive the motor and thus convert it back into a generator. If the unidirectional excitation of this motor be altered, it will be found that the machine, while performing a constant amount of work, will absorb a current the magnitude of which will vary with varying magnitude of the unidirectional excitation. It will also be noticed that the phase of the current will vary relatively to the phase of the emf impressed on the terminals of the motor as the magnitude of the excitation is altered. It is known that a synchronous motor of this kind can be made to operate at unity power-factor at any desired load simply by adjusting the magnitude of the unidirectional excitation. Let, then, the load be kept constant and let this excitation be adjusted to what may be termed its "normal' value and for which the current taken




FIGS. 13 AND 14—SYNCHRONOUS MOTOR EXCITED TO TAKE LEADING CURRENT—SPACE AND PHASE RELATION OF EXCITING FLUX TO WORKING EMF, BACK EMF AND ARMATURE REACTION FLUX

by the motor exactly coincides in time-phase with the emf at the terminals thereof. Then, as was the case when the machine was operating as a generator, the conditions depicted in Fig. 8 will obtain, except that the armature reaction curve shown in that figure will be inverted; but the relative position of its maxima with respect to those of the exciting flux will be the same, as is clearly indicated in Fig. 11. This inversion of the armature reaction curve 24 of Fig. 8, when the machine operates as a motor and not as a generator, is due to the fact that curve 24 represents in Fig. 8 a current $I$ in time-phase with the emf generated in the machine. Now, when the machine operates as a motor, this generated emf becomes the back emf $e_1$ of such motor and opposes the working emf $e_2$ impressed on the terminals of the machine, while the motor current $I$, for unity power-factor, coincides in time-phase with the impressed working emf, and is therefore opposed by the generated or back emf. In other words, and other things being equal, the current taken by a machine operating as a motor is of opposite direction to the current delivered by this machine when working as a generator.

Now assume that the unidirectional excitation is increased. In an ordinary motor the natural consequence of such an increase of excitation would be a permanent reduction in the speed of the machine, for if that speed is not reduced, the back emf of the motor must rise, thus reducing the current taken by the machine and cutting down the power delivered by it. However, with a synchronous motor the speed cannot be permanently altered with-




FIGS. 15 AND 16—SYNCHRONOUS MOTOR EXCITED TO TAKE LAGGING CURRENT—SPACE AND PHASE RELATION OF EXCITING FLUX TO WORKING EMF, BACK EMF AND ARMATURE REACTION FLUX

out causing the machine to drop out of step and come to a standstill. It is, therefore, necessary for some other change to take place in order to enable this motor to cope with its constant load, notwithstanding the fact that the increased excitation tends to increase the back emf and thus reduce the power of the motor, or even turn it into a generator. The necessary change which actually does take place in the

machine results in a phase difference—that is, in an adjustment of the phase of the current taken by the motor relatively to the phase of the terminal emf and involves only a momentary change in speed. This adjustment is brought about by a momentary acceleration or retardation of the field poles relatively to the phase of the impressed or working emf, resulting in a different permanent set between the two.

Thus, in an ideal motor and with "normal" excitation, the permanent set of the two will be such that each pole will stand exactly opposite an armature coil every time the terminal or working emf $e_2$ reaches a zero value. This condition is shown in Fig. 11, where $e_2$ represents the impressed emf wave, 25 one of the armature coils, $e_1$ the generated or back emf wave, and where the dotted curve (24 of Figs. 8, 9, 10) represents the armature reaction flux which is co-phasal with the armature current $I$. The armature current $I$ depends on the resultant of, or on the vectorial difference between, the impressed and the back emfs. In an ideal motor the armature current will always be co-phasal with this resultant. Now, since for "normal" excitation the phase of the back emf $e_1$ exactly opposes the phase of the impressed or working emf $e_2$ and since the latter must be the larger, their resultant will coincide in phase and direction with $e_2$, as shown in Fig. 11, from which it appears that the armature reaction flux, for normal excitation of a synchronous motor, neither strengthens nor weakens the exciting flux.

The phase relations of working, back and resultant armature emfs and of armature current are also shown in Fig. 12, by means of an ordinary phase diagram.

Should the excitation be increased above the normal, then the speed of the revolving exciting field will be momentarily checked, and when equilibrium and synchronism are re-established it will be found that the permanent set between the phase of the impressed emf $e_2$ and the field poles is such that each of the latter comes to stand exactly opposite an armature coil, not every time $e_2$ reaches a zero value, but every time $e_2$ has passed its zero value and has reached a certain value greater than zero. This is clearly shown in Fig. 13, while from the corresponding phase diagram (Fig. 14) we gather the very important fact that when the phase of the back emf is not exactly opposed to the phase of the working emf then the phase of their resultant does not coincide with that of either of the components. This resultant is represented by the vector $R$ of the phase diagram shown in Fig. 14, and the resultant co-phasal current $I$, or the co-phasal reaction flux, by the correspondingly located wave $I$ in Fig. 13. It is seen that the leading current ($I$) taken by an over-excited synchronous motor produces an armature reaction flux wave $I$ which opposes the exciting flux at almost every point, thus reducing the effective exciting flux and consequently lowering the magnitude of the back emf, notwithstanding the fact that the exciting current has been increased and that synchronism—that is, a constant speed—has been maintained except for a momentary irregularity.

The angle by which the synchronously rotating field poles are permanently retarded when the machine is over-excited, automatically assumes just that magnitude which will cause the armature reaction to demagnetize the machine to an extent sufficient for the latter to take all the current necessary for dealing with the load intrusted to it. It will at once be evident that under-excitation must bring about exactly opposite effects, as is clearly shown by Fig. 15 and phase diagram 16.

From the above remarks it is seen:

(1) That in order to produce an alternating-current motor one must provide, in one way or another, a unidirectional exciting flux (of adjustable magnitude), must cause this flux to revolve relatively to a fixed armature, or vice versa, and must insure that this flux shall revolve in synchronism with the alternating emf impressed on the motor terminals. (Since the impressed emf is an alternating one, the back emf generated in the motor must also be alternating and must have the same frequency as the terminal emf if it is to oppose the latter successfully. Such a back emf can obviously only be produced by a synchronously revolving unidirectional exciting flux.)

(2) If an alternating-current motor constituted in the manner described is "normally" excited, the current taken by it will be co-phasal with the terminal emf, the armature reaction flux will not affect the magnitude of the exciting flux and will only tend to distort it.

(3) In case such a motor is over-excited the current taken by it will lead the impressed emf, and the armature reaction flux will oppose, or take from, the exciting flux.

(4) In case such a motor is under-excited the current taken by it will lag behind the impressed emf, and the armature reaction flux will help, or add to, the exciting flux.

Attention is particularly directed to the fact that a variation of the phase of the back emf $e_1$ of a motor relatively to the phase of the working emf $e_2$ impressed on its terminals results in a change in the phase relation between the terminal emf $e_2$ and the current $I$ taken by the machine. A reference to Figs. 12, 14 and 16 shows that this is the very fact which enables a synchronous motor to operate either with power-factor of unity (Fig. 12, "normal excitation), or with "leading" power-factor (Fig. 14, over-excitation), or with "lagging" power-factor (Fig. 16, under-excitation).

A further discussion of the subject of phase compensation will appear in these columns in subsequent issues.

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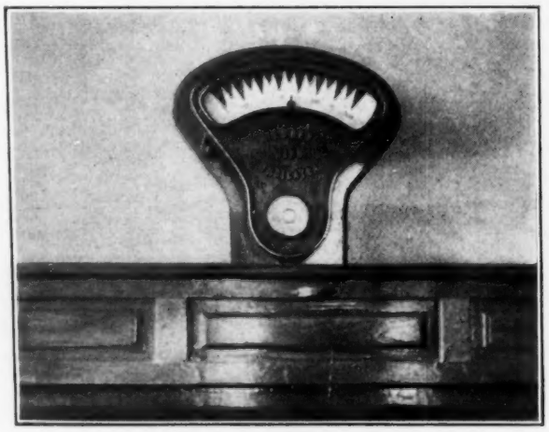
## An Electrical Weather Vane

To enable the direction of the wind to be observed under all weather conditions and at all hours a New Bedford (Mass.) street-railway man has designed the electrical weather vane shown in the accompanying photograph. The apparatus is operated by a dry battery which may be connected into the circuit by a push-button on the face of the indicator. The position of the pointer is determined by contact strips on the usual aerial weather vane, which is mounted on the roof of the carhouse. As the wind changes the contact strips are automatically changed to correspond, and the introduction of resistances in the different contact circuits enables the device, working on the principle of a voltmeter, to indicate the points on the scale calibrated to each of the eight principal points of the compass. This arrangement is of much value in assisting the transportation department to forecast changes in the weather which lead to changes in the car schedule or in the type of cars to be operated.



ELECTRICAL WEATHER VANE

# Central Station Management

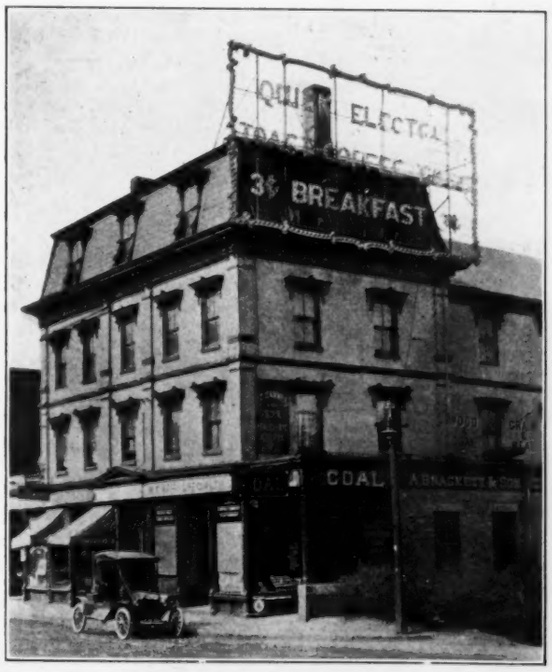
**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Electric Cooking in a Town of 2000

Mr. K. A. Steinhauser, secretary and manager of the Nashville Electric Light Company, Nashville, Ill., a town of 2000 population, reports gratifying success with an electric-cooking campaign, in the course of which eighteen electric ranges of the Hughes type have been added to its lines. This cooking business is found to be a good day-load and revenue producer. Most of the ranges are used for domestic purposes and at 3 cents per kw-hr. earn monthly incomes averaging $3.30. Others which are installed in hotels and restaurants bring in average revenues of $9 per month.

## Advertising Electric Cooking by Central-Station Energy

The accompanying photograph taken at Newton, Mass., on the system of the Edison Electric Illuminating Com-




ADVERTISING ELECTRIC COOKING

pany of Boston illustrates an effective electric flasher sign maintained at one of the best strategic points of the city for the present purpose of advertising the low cost of electric cooking upon the company's miscellaneous energy rates. The sign faces the principal railroad and trolley lines passing through Newton proper and can easily be read in Norantum Square, about 500 ft. distant. It is about 35 ft. long and 22 ft. wide and contains about 600 10-watt metallized-filament lamps. The menu of three items set forth can be cooked in the minimum time with an energy consumption of about 1 kw-hr. In the fewest words the sign hints at the low cost, speed and attractiveness of electric cooking. The brevity of the message carried enables the commuters between Newton and Boston and passengers on through expresses going past the Newton station to read the inscription understandingly.

## Illuminated Sign Exchange Plan at Kansas City

A little more than a year ago the Kansas City Electric Light Company perfected an agreement with the Thomas Cusack Sign Company whereby the former agreed to furnish energy for the illumination of 250 linear feet of bulletin board and the latter agreed to paint the advertisements

FIG. 1—CENTRAL-STATION DISPLAY ON SIGN COMPANY'S BOARD

and equip the boards with lamps and reflectors. It was further agreed that when any customer of the sign company desired a lighted board the electric-light company was to vacate, its own display being taken elsewhere. The sign company's contract with the customer for lighting the signboard included the equipment and maintenance of the lamps. This arrangement served a double purpose as it not only gave the central station the benefit of the advertising but by attracting attention induced other advertisers to follow the example, so that within one year 2700 additional linear feet of lighted signboard have been installed.

You would hardly know it was Summer
Nothing Hot – but the iron
LET US WIRE YOUR HOUSE FOR
ELECTRIC LIGHT
the ROTARY
ACME MATTRESS CO.

FIG. 2—ELECTRICALLY LIGHTED BULLETIN BOARD AT KANSAS CITY

One sign is installed on the roof of a two-story building at an important corner of the city. By the use of colored lamps and a flasher, changes in color are obtained on the face of the sign, tending to make it more attractive and efficient. Before the lighting company started its own signboard lighting there was not a board in the city working at night.

### Large Factory Sign on Central-Station Service

The accompanying photograph illustrates a large electric sign on the roof of the factory of the Library Bureau, at Cambridge, Mass., on the circuits of the Cambridge Electric Light Company. The sign, one of the longest in Greater Boston, measures 100 ft. by 20 ft. and is mounted

FACTORY SIGN

at a height of about 60 ft. above the ground. It is formed by 312 2-cp, 110-volt carbon incandescent lamps set against a backing of dark-colored galvanized iron and is supplied with energy through a small transformer on the roof which is connected with the local 550-volt motor-service feeders in the factory. The sign is of the fixed type, faces the Charles River Basin and is run on weekdays from dusk until 11:30 p. m. It is easily legible for more than a mile and can be seen by passengers on the principal streets and steam railroad lines entering Boston proper on the west side of the city.

### Disinfecting Books with an Electric Blower

Every public library faces the problem of disinfecting its books so as to prevent the spreading of contagious diseases, which in some localities has become a serious problem. From Los Angeles, Cal., comes the suggestion that the books be placed on a revolving rack against which small motor-driven blowers force jets of air. The breeze not only rotates the whole rack but also spreads out and flutters the leaves so that the air can readily pervade them. By dropping some disinfectant into the chamber from which the blowers get their supply of air, the fluid can be finely distributed through the books.

### Forty-two Household Uses of Electricity

In the June number of its monthly publication, *The Silk Cord,* the Electric Development Association of New England, Boston, Mass., presents a list of forty-two household uses of electricity, making up an array of domestic applications well worth a little serious consideration. Following are the uses suggested: Heat water for shaving or the bath; percolate the breakfast coffee; toast bread; fry eggs or anything that will fry; poach eggs, cook the cereal or heat milk; operate the washing machine and clothes wringer; iron the clothes; run the vacuum cleaner; operate the sewing machine; cool rooms with an electric fan; knead the bread and bake the bread; with a motor, grind, mix, churn, whip cream, make ice-cream, polish silver, etc.; heat a fireless cooker; heat the electric range; make the tea in a samovar; cook food in a chafing dish; curl a woman's hair; dry a woman's hair; ignite cigars; furnish illumination for the house; heat the bathroom and other rooms on cool mornings; keep hot the heating pad (used in place of hot-water bottle); warm the milk for baby day or night; pop corn; protect houses from burglars; amuse the children by running electric toys; give electric baths in bath cabinets; carry the family in the electric automobile; warm an electric blanket for out-door sleeping; purify the drinking water; polish the floors—electric floor polisher; dry the wash—electric drier; sterilize water or utensils; make ice—furnish refrigeration; play the piano; mix family beverages; lift or lower dumb waiters; supply electric treatment; vibrate the massage vibrator; ozonize (purify) the air; thaw frozen pipes; wash dishes.

### 400 hp to Ventilate Appalachian Tunnel

The Appalachian Power Company, of Bluefields, W. Va., recently closed a contract with the Virginia Railway & Power Company for furnishing electrical energy to operate ventilating fans in the Allegheny Tunnel of the railway company. The total rating of the motors will be 400 hp. During the construction of this tunnel it is also probable that the electric service company will secure temporary business from the contractor who has the work in charge.

The work of securing additional contracts for electrical energy used in mining continues, and it is expected that several contracts for such business will be closed shortly. The weekly energy output of the company is now approximately 700,000 kw-hr. and is increasing steadily. Last April the Appalachian company had a connected load of more than 26,000 hp, and there remains a large field for securing new business. An illustrated twenty-four-page booklet entitled "Hydroelectric Power in Southwest Virginia" has been prepared by the company and will be ready for distribution about July 1. The booklet describes the Appalachian Power Company and the territory served and gives the history of the construction of the two hydroelectric developments which have been in full operation for some months.

### Agricultural Service in California Delta Lands

By R. B. Mateer

At the junction of the Sacramento and San Joaquin Rivers in California are the delta lands, reclaimed from a valueless swamp and comprising some 750,000 acres. This land, now protected by strong levees and equipped with great motor-operated reclamation pumps, is of unsurpassed

FIG. 1—LEVEE HOUSE FOR MOTOR BELTED TO PUMP

fertility and possesses wonderful possibilities for ranching, dairying, truck-gardening and diversified farming.

In this territory the Great Western Power Company of California has extended its 22,000-volt feeders and is now supplying energy for irrigation and general agricultural purposes. The connected load of some 4644 hp was obtained as a result of an aggressive sales campaign in the



result is attributable to the diffused character of the illumi-

fall of 1912 and the spring of 1913. The motors, in the majority of cases belted to pumps ranging from 4 in. to 16 in. in size, vary from 7.5 hp to 75 hp in rating and are operated from 220-volt, 60-cycle, three-phase secondary circuits.

All energy necessary for irrigation, lighting, heating and

FIG. 2—BELTED CENTRIFUGAL PUMP ON LEVEL BANK

general agricultural purposes is metered at one point at one voltage and is charged for according to the accompanying schedule. Where the energy consumption per hp of motor

RATES FOR ENERGY USED IN AGRICULTURAL SERVICE

| Kw-hr. per Hp | Price, Cents | Kw-hr. per Hp | Price, Cents |
|---|---|---|---|
| 31 to 42 | 2.9 | 221 to 250 | 1.9 |
| 42 to 55 | 2.8 | 250 to 280 | 1.8 |
| 55 to 70 | 2.7 | 280 to 312 | 1.7 |
| 70 to 86 | 2.6 | 312 to 346 | 1.6 |
| 86 to 105 | 2.5 | 346 to 381 | 1.5 |
| 105 to 124 | 2.4 | 381 to 418 | 1.4 |
| 124 to 146 | 2.3 | 418 to 457 | 1.3 |
| 146 to 169 | 2.2 | 457 to 498 | 1.2 |
| 169 to 194 | 2.1 | 498 to 540 | 1.1 |
| 194 to 221 | 2.0 | Over 540 | 1.0 |

rating is less than 31 kw-hr., the rate of 3 cents per kw-hr. applies. For other consumption per hp of motor rating, the rates are as given in the table.

## Operation of a Complaint Department

Several outside central-station men who have studied the complaint department of the Western States Gas & Electric Company, Stockton, Cal., declare that this division is one of the best organized and equipped among public utility companies in the West.

The policy of the Western States complaint department, declares Mr. A. G. Halloway, who is in charge, is to shape its attitude toward the public so that the consumer is bound to feel that by simply calling attention to a real or imaginary wrong it will receive prompt attention. A patron of the company is made to feel that in making a complaint he is honest in his belief that a wrong exists, and no matter how trivial the complaint may appear to be it is gone into thoroughly.

When a complaint is entered it is carefully recorded, and the correct name and street number are taken. The department at once tries to find out the cause of the trouble, in order to enable it to determine to whom the order should be sent for prompt execution. The head of this department follows each order carefully and sees that it is executed promptly and satisfactorily. The company believes that a satisfied customer is the best kind of an advertisement.

The complaint department is fully equipped with electrical appliances such as recording voltmeters, banks of lamps, both carbon and tungsten, etc. Connected to each lamp bank is a wattmeter, its dial graduated directly at the rate at which energy is sold and so arranged that by turning on any one of the lamps the consumer can be shown how much that unit costs to operate in cents per hour. This graphic-comparison method has enabled the Western States company to settle many disputed bills to the entire satisfaction of the complainant.

In all cases of complaint other than tests and "re-reads" return post cards are sent out. On tests and "re-reads" an individual letter is sent to the complainant. The originals are filed alphabetically and the duplicates numerically during the current month, at the end of which they are removed and bound and placed in the company's vault, but a book entry is also made of all complaints.

A trouble man is on duty during the day and another during the night, the latter's report indicating what has occurred during his hours of service. Mr. Halloway lays great stress on the importance of this subject of handling complaints, the manner in which the customer is received, and the interest manifested in the complaint.

The success of such a department often depends largely on the man at its head. He should be a man who understands the business thoroughly, for necessarily he must deal with a wide variety of complaints—high bills, poor service, setting of or removing meters, adjusting overcharges, re-reading meters, opening and closing meters and testing meters—as well as settling any and all disputes and adjusting all claims against the company in such a way as not to offend the customer.

## A Hot-Weather Window Display

A window display installed by the Kentucky Electric Company in its spacious display room on the principal business street of Louisville has done much to stimulate the sale of electric fans. The central figure is a healthy-looking snow man about the size that would be made by an expert boy with plenty of snow at his command. The body of the figure was constructed of excelsior wrapped over a wooden frame and covered with white cotton and mica dust, and the figure is complete even to the bits of coal used for eyes and nose. A bit of realism is added by the presence of a boy's sled, lying just as the urchin is supposed to have left it in the snow

A "SNOWBOUND" ELECTRIC FAN DISPLAY AT LOUISVILLE, KY.

Conspicuous in the group of electric fans in the window is the one in front, the guards of which are covered with cotton. This fan is kept constantly in motion and produces the effect of snow driven by the wind. The timeliness of the display may be understood when it is explained that it was put on exhibit on a day when the thermometer registered 98 deg. Fahr.

# Illumination and Wiring

## Intensities of Natural and Artificial Light Required for Reading

By J. R. Cravath

The statement has been made frequently that with natural lighting outdoors a higher intensity of illumination in foot-candles is required for reading and similar work than with artificial light indoors. Various theories have been advanced to account for this. The tests here described, made by the writer, indicate that this old idea is fallacious and that the difference, if any, is in the opposite direction.

The intensity of artificial illumination required for comfortable reading of ordinary newspapers and magazines has been tested at various times by Messrs. Preston S. Millar, A. J. Sweet, the writer and others. The amount required has been found to vary considerably, depending on the person, the surrounding conditions and the direction from which the light is received on the page. Glare from the paper (which is the popular term for specular reflection from the paper) has considerable influence on the amount of light any given individual will require for reading. The less glare received from the paper the lower the illumination required. Taking the general run of results obtained from artificial lighting, it may be said that most individuals will ask for an intensity of from 1 to 2 ft.-candles for ordinary reading. Many can read comfortably under favorable conditions with intensities from 1.0 to 0.5 ft.-candles, or lower. These tests on the intensity of artificial illumination required have usually been carried on by increasing or decreasing the light by means of a rheostat inserted in the circuit supplying energy to the lamps.

The writer has made a few rough tests outdoors at sunset and sunrise on the illumination required for comfortable reading. These tests, while not very extensive, are sufficient to indicate that no extra large quantity of natural light is required, as has sometimes been stated.

One test made during a clear sunset with the subjects on an open lawn facing south showed that about 1 ft.-candle was considered comfortable for reading both by the writer and one other subject. For the writer this was ample, but his companion would choose more if given free choice. When the illumination on the page had decreased to 0.22 ft.-candle the writer could still read without much strain, although his companion could not do so.

A test made during a heavily clouded sunrise with the writer as a subject on the east side of a building facing east showed that he could read easily with an illumination of 0.15 ft.-candle. At 0.42 ft.-candle he could read very comfortably and at 1.26 ft.-candle the illumination seemed ample for ordinary purposes. It should be explained here that the illumination intensities considered ample by the writer on a number of previous tests with artificial illumination were from 1.3 to 3.3 ft.-candles, depending on the direction of the light and the surroundings. This is considerably higher than required outdoors in the tests herewith recorded.

In another test made at sunset on the east side of the house with the writer seated facing east, reading was very comfortable with 1.15 ft.-candles. With an intensity of from 0.98 to 0.69 ft.-candle the illumination seemed a little lower than one would want steadily. At 0.63 ft.-candle the illumination was insufficient for steady work, although entirely comfortable for temporary work. From 0.45 to 0.34 ft.-candle the illumination was still sufficient to make brief reading easy. Reading began to be difficult at 0.25 ft.-candle, and at 0.16 it was decidedly difficult.

In all of the above daylight tests the writer was impressed with the comfort with which reading was done as compared to similar tests made under artificial light for which the writer has frequently been a subject. This result is attributable to the diffused character of the illumination, which gave a minimum of reflected glare from the paper.

The low illumination required in the sunrise test as compared to the sunset was to be expected because the eye had become accustomed to darkness before the sunrise test and the illumination was gradually increasing rather than diminishing.

These results, as far as they go, indicate that daylight illumination in the open is satisfactory for reading at intensities as low as with artificial light and probably lower.

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## Electric-Lighted Showcase for the Plate-Glass Storeroom Door

The plate-glass door of the average storeroom occupies valuable display space, of which, however, little use is ordinarily made. Realizing this, an astute shoe merchant in a southern Ohio city had an electric-lighted showcase built, as shown in the sketch, to be hung behind the glass door after business hours. Connection to the lamps inside is made by a flexible cord which can be plugged into an outlet at the side of the door. A couple of 60-watt tungsten lamps light the little box profusely, and the unique display draws more than its share of attention from the passing public.

ELECTRIC-LIGHTED SHOWCASE FOR DOOR

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## Cost of Chicago's New Street Lighting

Several committees of the City Club of Chicago on June 18 made an inspection trip over some of the recent new electric street-lighting work being carried out in Chicago. At the luncheon preceding the trip Mr. Ray Palmer, city electrician, explained the systems adopted and gave some interesting figures on cost of construction and operation. The two systems used were described and illustrated in the *Electrical World* of Oct. 12, 1912.

### Flame-Arc System

The system most generally used over the city employs flame-arc lamps which operate about 100 hours between trimmings. These lamps are on 10-amp, 60-cycle circuits and take from 55 to 65 volts per lamp. They are spaced about twenty-three to the mile or an average of one to every 230 ft. of street, and with the exception of a certain central underground district, the line work is carried overhead on tubular steel poles. The lamps are mounted 25 ft. above the pavement. The total first cost per mile of this system was $3,700, not including generating plant but including the substations. The cost of operation per mile is $1,200 per year, or $52.30 per lamp. Public by-product water-power furnishes the energy.

### TUNGSTEN SERIES UNDERGROUND SYSTEM

Another system is being used on some residence streets where there are many low trees and where the property owners prefer smaller lamps more closely spaced. This system consists of 80-cp series tungsten lamps spaced seventy-five per mile of street. These are mounted on very neat iron poles formerly used for gas lamps, the gas lantern being removed and a light opal ball substituted therefor. The lamps are operated on 4-amp series circuits laid underground in No. 6 lead-covered and double-steel-taped single-conductor cable buried about 13 in. below the surface in the parkway just inside the curb. This is very much cheaper construction than any kind of underground conduit and involves very little disturbance of the street. The first cost per mile of this system was $8,800, not including generating plant but including the substations. The cost per mile of operation is $1,800 per year, or $24 per lamp. The cost of furnishing and laying the steel-taped cable is estimated at 50 cents per foot. This would make the labor cost about 30 cents per foot. In this connection it should be stated that repair work has been very carefully done so as to leave the street in as good shape as it was found.

## New Rules Governing Overhead Wire Crossings in Illinois

The Illinois Railroad and Warehouse Commission, in its Synopsis of Proceedings, issue No. 12, recently distributed, gives a set of thirteen rules adopted for the regulation of overhead-wire crossings with steam railroads, abstracted herewith.

All wire crossings are divided into two classes, those of 700 volts or more and those of less than 700 volts. No wires of the former class shall be permitted to cross the tracks of any railroad, or the wires on the railroad right-of-way, until complete plans, including maps and profiles, shall first have been submitted to the commission and approved by formal order. At all crossings of this class suitable danger signs stating the voltage of the circuits must be attached to each pole upon or adjacent to the right-of-way. If the wires of any telegraph, telephone or electric railway company are crossed at the same location, the minimum vertical clearances between wires shall be 7 ft.

All wires of this class (except trolley wires) shall in general have a total vertical clearance of not less than 35 ft. when not suspended from messenger wires. If suspended as last mentioned, at intervals not greater than 15 ft., the clearance shall be not less than 30 ft.

Trolley-wire crossings must be equipped with an approved trolley guard, and the minimum clearance above the rail top shall be 22 ft.

All wires carrying less than 700 volts (except trolley wires) shall in general have a clearance of not less than 25 ft. if suspended from messengers at intervals not exceeding 15 ft., or if not so suspended, the clearance must be at least 30 ft. But where the wires of other companies are crossed at the same location the smallest vertical clearance between wires must be 5 ft.

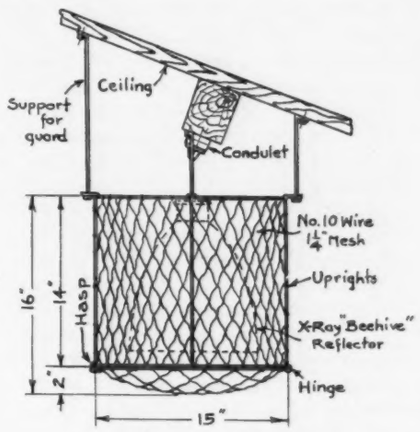
In every case the wire crossing, where wires of other companies are also crossed as mentioned, must be equipped with a slatted platform or some other approved type of protection, to prevent wire contacts in case any of the upper wires fail.

The clearances prescribed must exist under the most unfavorable conditions with respect to loading and temperature. If smaller clearances than those here mentioned appear to be desirable, application must be made to the commission for special permission by order to depart from the rules, giving full data, maps, profiles, etc.

These rules were approved Nov. 21, 1912.

## Mounting of Lamp Guards in Gymnasium

In gymnasiums, hand-ball courts, indoor-tennis courts, etc., tungsten lamps should be protected against the chance impact of balls thrown by players by installing a wire screen or guard of some kind around the lighting units. Frequently the mistake has been made of attaching these guards to the lamp-holders themselves, with the result that when a ball struck the screen the jar and vibration transmitted to the whole fixture was sufficient to break the filaments, especially if the lamps happened to be cold. The accompanying sketch shows the improved method of supporting the guard screen used in the case of a recently completed gymnasium in which the protector is separately mounted entirely clear of the lamp fixture and reflector. The bottom of the wire basket is hinged and held closed with a hasp, so that access is made easy for renewing lamps and cleaning globes and reflectors.




GYMNASIUM LAMP GUARD

## Recent Telephone Patents

### EXCHANGE SYSTEMS AND APPARATUS

With the introduction of automatically applied ringing at central offices, especially in connection with trunking, the necessity for an intermittent current supply became at once apparent. In the ordinary system of automatic ringing the response of the called station disconnects the source of ringing energy. The usual periods used are two seconds of ring followed by four seconds of silence. It will thus be seen that a possible delay of four seconds may occur after connection, before ringing begins, while there is a probable delay of at least two seconds.

It is to obviate this difficulty that Mr. W. G. Blauvelt, of New York City, has introduced an auxiliary switching device by means of which ringing is immediately applied irrespective of the particular position of the controlling interrupter. After a preliminary ring the regular interrupter is applied for any further ringing that may be necessary. Mr. Blauvelt provides a rotating shaft upon which is secured a set of cams each controlling contact springs. The whole set is caused to rotate by means of a ratchet wheel and stepping pawl. This pawl is controlled by an interrupter, the circuit of which may be closed and opened not only through the contacts associated with the cams but also through those of various relays and of a rotating commutator, the segments of which pass its brushes at half-second intervals. When a calling plug reaches a line, energy for ringing is immediately applied for a half second. Simultaneously the switch is advanced, cutting off this ringing supply and switching in the regular supply. The patents for this system have been assigned to the American Telephone & Telegraph Company.

A patent granted to Mr. M. L. Johnson, of Chicago, and assigned by him to the Corwin Telephone Manufacturing Company, describes a method for preventing "listening in" by operators. A control circuit is conducted through two relays, one of which is associated with the calling cord and one with the answering cord of each cord pair. Both of these relays are in operation as long as both parties to a connection have their receivers down. Under this condition should the operator throw the listening key of the connecting cord pair a relay associated therewith will short-circuit the operator's set and ring a buzzer to call attention to the attempted infraction of the rules.

Another patent granted to the same inventor and similarly assigned refers to systems of cash service where prepayment is required. According to this proposed system the subscriber may signal in the usual way by removing his receiver and may hear the response of the operator and give the desired number. When connection is made to the desired line the calling party loses his transmitter connection but can hear the response of the called party. A phonograph is arranged to ask the called party his number and to instruct the caller to drop a nickel. This being done, the restraint is lifted and conversation may then begin.

Mr. P. C. Burns, of Chicago, recently obtained a patent for a special type of small switchboard, described in the *Electrical World* of June 21, 1913, in which the apparatus was especially designed for removal without disturbing the permanent wiring. The jacks and drops were individually combined and all contacts were maintained mechanically. A patent has now been granted to him for a similar board wherein lamp signals have replaced the drops.

Mr. F. Wöhler, of Hanover-Linden, Germany, has obtained a patent for an automatic telephone system, which he has assigned to the Western Electric Company. This system provides for so-called restricted service; that is, some stations of a group have universal service and others are restricted to calls within the groups. The system of Mr. Wöhler provides for this feature and in addition contemplates that a call from a universal service station to another of the same class shall serve to intercept any existing call between the desired station and any restricted station.

A complete automatic system is described in the patent granted to Mr. J. Peticky, of Austria-Hungary. This system provides the usual features, comprising sending apparatus and the various selectors and connection apparatus for a four-digit system.

### Subscriber's Station Devices

Many receivers have been produced to operate without a permanent magnet, depending upon a steady current in the windings for the initial magnetization. Such a receiver has been patented by Mr. E. R. Corwin, of Chicago, and has been assigned to the Corwin Telephone Manufacturing Company. The diaphragm is placed upon a shallow circular pan and held between the shell and the ear cap. The pan has two slits to receive the ends of the pole pieces. Another patent granted to the same inventor describes the method of use of this receiver with its two coils in parallel and in series with the transmitter.

A transmitter for picking up and concentrating sound vibrations is the subject of a patent issued to Mr. W. J. Marchant, of London, England. The mouthpiece is of parabolic section, truncated at the focal point, the diaphragm being carried so as to be in this plane. For adjustments a series of screens are provided, one or more of which may be placed over the mouthpiece.

Mr. Felix Gothschalk, of Stirling, N. J., has invented a transmitter in which a strained diaphragm is used. The diaphragm is stretched radially by a clamping ring. The connection between the diaphragm and front or movable electrode is effected through a symmetrical spider the legs of which make contact with the rear of the diaphragm some distance from its center and concentric with its periphery.

An antiseptic device invented by Mr. C. R. Phillips, of Richmond, Va., which consists of a diaphragm somewhat larger than the face of a transmitter, has a concentric channel formed in it about a central perforation. A fiber ring soaked in antiseptic material is pressed into the channel and the diaphragm is clamped against the mouthpiece with the open face of the channel inward. The whole device is held in place by a wire ring engaging ears which clamp over the lip of the mouthpiece.

# Letter to the Editors

## Fuse Economy

*To the Editors of the Electrical World:*

Sirs:—An article appeared in the *Electrical World* of May 17 by Mr. Harvey S. Pardee on "Fuse Economy," in which he discussed several phases of the situation of vital importance to the fuse-buying public. The writer wishes to take exception to the conclusion of the author, which may be true in an academic sense but is entirely irrelevant and misleading as regards the present refillable-fuse situation.

He states that "an economic demand cannot be resisted indefinitely, and there exists at present a real demand for a refillable fuse which shall be reliable as to rating, cheaply refillable and reasonably fool-proof; that is, one that cannot be improperly refilled by anyone who may undertake to do so." It is readily granted that some demand always exists in every line of business for a supposedly cheaper product that is "just as good," but we must deal with conditions as they now are and not with mere theories of this kind.

The agitation at present on foot to have the insurance underwriters approve certain makes of refillable fuses now on the market does not aim to standardize refillable fuses "that cannot be improperly refilled by anyone who may undertake to do so," but rather to permit the use of fuses that anyone can reload in any manner, either good or bad.

The existing reloadable fuses are refilled by replacing their blown fusible element with new ones. Mechanical limitations as to the size of the new element can be built into such fuses, but no limitation can be put on the character of the material of which the new fusible links are made.

The ease with which any existing make of refillable fuse can be reloaded improperly gives rise to a sufficiently serious fire hazard to warrant the underwriters in refusing to approve them. Instances have come under the writer's observation in which refillable fuses of normal appearance were found to be fused at double their rated capacity in ordinary service.

Mr. Pardee's letter gives the idea that a great demand exists for refillable fuses which are as reliable as approved cartridge fuses. It may throw some light on this matter to point out that manufacturers of approved fuses have made a regular business of reloading blown fuses in an approved manner for years, at prices which effect a saving of about 60 per cent of the cost of new fuses. In spite of this, the number of fuses returned to the manufacturers for reloading is only a few per cent of the number of new fuses made.

We may agree with Mr. Pardee that some demand exists for a refillable fuse as good as the present approved inclosed fuse, but we have not yet seen the device which satisfies this desirable but unattained end.

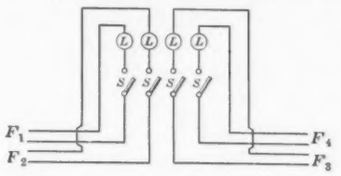
R. C. Patton,
*Electrical Engineer, D. & W. Fuse Company.*
*Providence, R. I.*

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Field Excitation Test Lamps

A useful adjunct to the operating equipment of a large Western turbine station is a bank of lamps and switches by means of which the floor attendant can determine at any time which machines have their fields excited. The small lamps of the bank, which is mounted on a pedestal at




FIELD EXCITATION TEST LAMPS

the center of the turbine room, are each connected in parallel with one of the turbine fields, and by closing its corresponding switch momentarily the operator can test to find on which units the excitation switches are closed.

## Methods of Charging Storage Batteries

A detailed discussion of the various methods of charging storage batteries for use with straight-storage, head-end and axle-generator systems of train lighting was presented before the recent Atlantic City convention of the Association of Railway Electrical Engineers by its committee on battery-charging methods, of which Mr. J. R. Sloan, of the Pennsylvania Railroad, is chairman. Of general interest will be the account of the methods for straight-storage operation which have applications in other fields. Six schemes were outlined, as follows, the committee by a majority vote recommending the method of constant-potential charging with ballast resistance, using ampere-hour meters and shunt-trip circuit-breaker on each car.

*A. Rate of charge and ampere-hour input determined by operator based on voltage test on arrival and time available, the charging current being regulated by manipulation of rheostat.*

This method of charging, while probably used to a greater extent than any other method, cannot be considered satisfactory. To obtain the best results the following elements must be considered and proper allowance made for each:

Make and type of battery.

Actual capacity of battery.

Physical condition of battery, with respect to sulphate, density and level of electrolyte, temperature, short-circuits, condition of connections, etc.

Rate at which the battery is discharged when determining arrival voltage test and the length of time this discharge continues before making test.

Time that has elapsed between the termination of discharge in service and the time of test for voltage.

Drop in voltage in the battery connectors and in the car wiring.

Time available for charging.

Accuracy of the voltmeter itself and the accuracy with which it is read.

It is obvious that many of these factors are unknown quantities to the operator, and, therefore, he cannot give them all proper weight. Furthermore, when there are a great number of cars to be charged the charging rate to the battery on each car cannot be followed closely.

At the smaller terminals better results could probably be obtained, especially if battery voltage readings are frequently taken during the charge to determine when the voltage has reached a maximum, but the method as a whole is considered unsatisfactory.

*B. Charging current held approximately constant by manipulation of rheostat and state of charge of battery determined by constancy of voltage pilot cell, readings being taken at intervals during charge.*

This method of charging is dependent upon the accuracy with which the voltmeter is read and the assumption that the remainder of the cells are exactly similar in all respects to the pilot cell. It is essential that when obtaining the voltage readings the charging current be maintained at the same rate and that identical values be obtained with successive readings at least a half hour apart.

It is known that the assumption made above is erroneous, but nevertheless, if properly handled, this method will undoubtedly result in prolonging the life of the battery over that obtained with the first method mentioned, but it is believed the cost of operation will be excessive on account of the amount of labor involved in holding the current constant and in obtaining the successive voltage readings.

*C. Charging current held approximately constant by manipulation of rheostat and state of charge determined by constancy of specific gravity of electrolyte of pilot cell, readings being taken at intervals during charge.*

This method is dependent upon:

Class of battery.

Temperature of electrolyte, variations of which must be corrected for.

Accuracy with which the hydrometer is read and the care taken to get a representative sample and the assumption that the remainder of the cells are exactly similar in all respects to the pilot cell.

When taking the specific gravity readings it is essential that identical values be obtained with successive readings at least a half hour apart.

Like method B, it is known that the assumption that all cells in the battery are exactly similar to the pilot cell is in error, but nevertheless, if properly handled, this method will undoubtedly cause less depreciation of a battery in a given time than method A. However, it is believed that the cost of operation on account of the amount of labor involved in obtaining the successive specific-gravity readings would be even greater than with method B.

*D. Charging current maintained approximately constant by automatic resistance, the resistance being controlled by a thermostat governed by the charging current.*

This method of charging is satisfactory in theory (if proper means are provided for terminating the charge), inasmuch as the charging rate can be set at a value which does not tend to produce undue depreciation of the plates. In practice, however, it is not flexible, as in case of cars with short layovers the rate of charge cannot be increased without adjusting the apparatus to permit higher currents. It has also been found that the thermostat is affected by weather conditions, there being considerable variation in the current flow, without any change having been made in

the adjustment, according to the variation in temperature, wind velocity, etc.

*E. Charging current held approximately constant by manipulation of rheostat, and ampere input determined by ampere-hour meter. This meter so designed as to compensate for the ampere-hour efficiency of the battery when the battery is fully charged, acting to complete a circuit through the trip coil of a circuit-breaker. This breaker when opened cuts the battery off charge.*

This method of charging is dependent upon the accuracy of the meter. The meter should, therefore, be checked for calibration at regular intervals. As an additional check on the meter, voltage and specific-gravity readings at several pilot cells should be taken during the latter portion of charge so as to determine that when the meter indicates a complete charge the battery is actually in that condition. It is believed that this method will give better results than any previously mentioned. In order that the gravity readings may be reliable, the level of the electrolyte in all cells should be adjusted previous to beginning the charge, and the specific gravity of the electrolyte in all cells corrected after charge is completed, allowance being made for temperature.

*F. A definite fixed resistance is placed in series with the battery and a definite constant voltage is maintained across both battery and resistance.*

With this method the ampere-hour input is determined by an ampere-hour meter operating a circuit-breaker to cut the battery off charge as in method E.

Care must be exercised in determining the proper resistance and voltage to use, and especially must the voltage be held very closely approximating the predetermined value chosen. It may be said in general that the higher the voltage chosen (which conditions the use of the greater charging resistance) the greater will be the permissible fluctuation of voltage. Increased voltage, however, increases the amount of energy consumed and reduces the amount of the "taper" effect.

The committee believes that this system, known as the constant-potential system, is most preferable of the various systems considered for charging batteries operated in straight storage service for the reasons that:

The minimum amount of attention is required from the operator who has only to connect the batteries to the charging plant.

Resistance and voltage being taken at such values as to permit using the highest current rate that will not injure the battery, the latter will be fully charged in a minimum time. Since the current is reduced to normal at end of charge, excessive evolution of gas at this portion of charge is avoided, thus maintaining the efficiency of charge and minimizing the depreciation of the battery.

Overcharging of the battery and so wasting power is eliminated, as energy is automatically cut off on completion of charge.

The results obtained will depend upon the accuracy of the meter and the constancy of the voltage. With regard to this point the remarks under method D apply equally well.

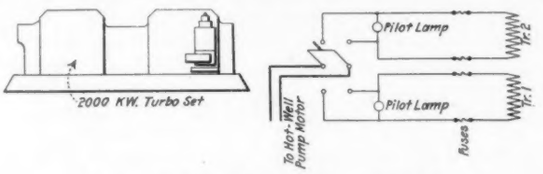
This method has the disadvantage that the rate of current flow is affected by the physical condition of the battery, that is, whether the cells are short-circuited or sulphated by the temperature, level and specific gravity of the electrolyte, age of battery, and whether antimony and certain impurities are present in the cells.

It has the further advantages that for the best results it is probable that different terminal voltages and resistance will probably be required for each of the three different types of batteries, namely, Faure, Planté and Edison, although it is believed that very good results will be obtained if the initial charging rate (neglecting the first momentary rush of current) does not greatly exceed the three-hour or double normal rate and the final charging rate does not greatly exceed the normal or eight-hour rate of the Planté battery.

In a minority comment included with the report, Mr. R. Norberg declared that since a great percentage of batteries as actually operated are far from normal, such batteries would stand a great chance of damage if charged according to the recommended method F. He therefore proposed to recommend method F as theoretically the best method, where the voltage of the battery is normal and absolutely known, but for practical purposes under general service conditions he advised method E.

## Duplicate Operation of Hot-Well Pump

To insure the continuous operation of the hot-well pump, it is often advisable to provide for duplicate sources of power supply. In one Middle West plant mounted on the frame of a 2000-kw turbine set is a double-pole double-throw switch by means of which the pump motor can be thrown onto either its special transformer bank or a duplicate set provided for emergency operation in case the fuses of the first set are blown. Each circuit feeds a pilot lamp mounted on the machine frame, so that the attendant can observe at a glance if a fuse has blown in either line or if the operation of the pump has been interrupted.




CIRCUIT FOR DUPLICATE OPERATION

## Selecting Samples of Coal for Calorimeter Test

What method is commonly used for selecting representative samples of coal from the station supply when calorimeter tests are to be made? Are these tests of much value as station records? S. B. F.

Where coal is used for fuel it is very important that a regular analysis be made and a record kept, so that the coal consumption for different months can be compared. When a test is to be made on coal used for fuel an amount large enough to be representative of the shipment is selected and placed upon the shoveling floor. This pile of coal is then shoveled into two equal heaps and then one of these is selected and again divided. This process of division is continued until the amount of coal left in one heap is small enough to be subjected to calorimeter test. The calorimeter test can be made upon a small amount from each car unloaded during the month. Where the plant is of sufficient size to warrant the expense it is better to install instruments in the plant, so that an analysis can be made for each car of coal unloaded. The data thus obtained, together with the aid of a simple and inexpensive instrument for measuring the percentage of $CO_2$ in the gas of combustion, will be of great help in the boiler room.

## Indirect and Semi-Indirect Illumination

What is the distinction between indirect and semi-indirect illumination? E. R. M.

In indirect lighting all of the light is first projected onto the ceiling from which it is diffused throughout the room. In semi-indirect illumination part of the light reaches the working plane directly from the light source without undergoing ceiling reflection. Among the advantages of the latter form over pure indirect lighting are its higher efficiency and the absence of contrasting dark fixtures silhouetted against the brightly illuminated ceiling surface.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*The Present Status of the Unipolar Machine.*—C. TRETTIN.—The large unipolar machine driven by a steam turbine was originally developed in the United States, first by Noeggerath and later by Lamme, and has been able to hold its own in spite of some deficiencies of the first designs, since high-speed direct-current turbo-generators with commutators were formerly rather unreliable in operation or did not exist at all, the latter being the case in the United States. The rapid development of the steam turbine, which now is absolutely reliable for speeds of 3000 r.p.m. and outputs of 8000 hp, leads, however, to very serious requirements of a modern turbo-generator. The high-speed commutator direct-current generator has been much improved lately so that the unipolar machine can compete with the direct-current commutator machine successfully only in the limited field of generation of very strong currents at low voltages. A direct-current commutator machine of 3000 r.p.m. is now perfectly reliable in sizes up to 900 kw. The author outlines the designs of Noeggerath and Lamme and briefly discusses their differences. The Noeggerath design has recently been taken up and further developed by the Siemens-Schuckert company. The author discusses the inherent difficulties in the construction of unipolar machines. They are of two kinds, namely, electrical difficulties (reaction, eddy currents), which have been studied in detail by Noeggerath, and mechanical difficulties (stresses, centrifugal forces, etc.). It is pointed out that the future of the unipolar machine depends essentially on the material of the slip-rings, which has to fulfil the following requirements: The permeability should be as small as possible to avoid eddy currents; the voltage drop below the brushes should be as small as possible; the mechanical strength should be as great as possible; the material should remain nicely polished at high-current densities below the metallic brushes. The author thinks it is quite possible that a bronze will be found which fulfils these requirements. In plants in which very high currents are required at comparatively low voltages the disadvantages of the unipolar machine are of less account. These disadvantages are the high weight, the low efficiency (82 to 86 per cent), and the necessity of careful attendance at the brushes. The latter disadvantage may be overcome if it should be found possible later on to replace the metallic brushes by graphite or carbon brushes. The unipolar machine has at present one great advantage over all other types of electric generators. This is its great overload capacity. It is quite possible to short-circuit it at full voltage without any danger to the brushes and winding. It is also possible to overload it temporarily by even 300 per cent.—*Dingler's Polytechn. Journal,* Vol. 328, Nos. 9 and 10, 1913.

*Electrolytic Iron for Construction of Electric Machines.*—MAX BRESLAUER.—Electrolytic iron has recently been placed on the market in Germany. The author shows that considerable savings in active material in the construction of electrical machines can be obtained by the use of this chemically pure iron. He first discusses the magnetic properties of electrolytic iron in comparison with other kinds of iron and then takes up the use of electrolytic iron in the construction of induction motors and transformers. The paper is to be concluded in a later issue.—*Elek. Zeit.,* June 12, 1913.

### Lamps and Lighting

*Tungsten-Filament Lamps.*—An editorial discussion of the recent report on tests of tungsten-filament lamps made by the British engineering standards committee. The lamps tested were those on the market some eighteen months ago and showed great improvements over the older lamps but left much to be desired with respect to rating. The objects of the tests were to obtain data as to the degree of uniformity in the individual lamps composing batches of metallic-filament lamps of given nominal ratings, and also to obtain data as to the behavior of metallic-filament lamps on life tests, with a view of ascertaining the value of the watts per candle-power on life tests which corresponds to a given candle-power drop after 1000 hours. The lamps were assumed to have been manufactured to conform to the values of watts and candle-power which were advertised in the respective makers' catalogs for the rating in question. From the target diagrams and tables it appears that "individual lamps on the market at that time, with the exception of those of one maker, vary considerably from their normal ratings, while even that maker whose lamps do not so vary cannot flatter himself exceedingly, as the lamps in question were supplied to a government department, a type of consumer that is, as is well known, extremely rigorous with its lamp-testing, so that these particular lamps can hardly be considered an ordinary works product. As regards the results of the candle-power tests, only 40 per cent of the batches tested came within the percentage limits laid down by the carbon-lamp specification and the same percentage within the makers' suggested limits. On the wattage basis the percentages complying with the two specifications were 48 and 79 respecively." The percentage limit described in the British standard specifications for carbon lamps is $\pm$ 12½ per cent for candle-power and $\pm$ 8 per cent for watts. Life tests were conducted on a basis of 1.2 watts per cp—that is, the voltage was found at which each lamp consumed 1.2 watts per cp and the lamp was then run at this voltage for 1000 hours or until it broke. Lamps with a life of several thousand hours are exceptional. "Moreover, the percentage of lamps which do not exist even for 1000 hours is higher than would be believed, especially in the case of high-voltage lamps. The candle-power throughout, however, seems to remain sufficiently constant to be satisfactory, and this statement applies equally to both high-voltage and low-voltage lamps."—London *Electrician,* June 6, 1913.

*Regeneration of Incandescent Lamps.*—E. A. KRUEGER.—An illustrated description of his method of regenerating incandescent lamps in which most parts of the lamp can be used repeatedly and the cost of regeneration includes only the opening of the globe, substitution of new filaments and evacuation of the globe.—*Zeit. f. Beleucht.,* May 20, 1913.

*Metallic Filament.*—A note on a recent British patent (No. 9941, 1912) of F. Hansen and W. F. Mohr. To increase the specific resistance, tungsten oxide is converted into trioxide, to which is added boric acid-anhydride to saturation. This is then dried and heated in a neutral atmosphere and reduced by heating with zinc powder. The zinc is removed and is made into a paste and squirted. —London *Elec. Eng'ing,* May 29, 1913.

*Osram Lamp with Ductile Tungsten.*—H. REMANE.—An enlarged illustrated reprint of his paper presented before

the Polytechnic Society of Berlin, which has already been abstracted in the *Digest.—Zeit. f. Beleucht.*, May 20 and 30, 1913.

*Steel-Mill Lighting.*—C. E. CLEWELL.—An illustrated article giving notes on steel-mill lighting and emphasizing that overhead lighting is most important. Notes are given on the illumination of open-hearth furnaces, machine shops, foundries, pattern shops and loading sheds. A table is added giving engineering data from actual lighting systems in typical steel-mill locations by means of arc lamps, mercury-vapor lamps and tungsten lamps.—*Elec. Journal*, June, 1913.

**Installations, Systems and Appliances**

*Relays.*—A note on a recent British patent (No. 30,059, 1912) of F. H. Nicholson. A U-tube containing a conducting liquid, for example, mercury, is pivoted so that it can turn freely. A magnetic flux is maintained by a U-shaped electromagnet directly through the conducting liquid in the central portion of the U-tube through which the feeble currents are caused to pass. The interaction of the flux produced by this current with the permanent flux sets up a flow of the liquid, which, therefore, rises in one of the end chambers and falls in the other. The center of gravity being thus disturbed the tube tilts and closes the local circuit.—London *Elec. Eng'ing*, June 12, 1913.

*Resistors for High Temperatures.*—A note on a recent British patent (No. 111,380, 1912) of G. Cooper and the British Prometheus Company. The resistor surface is impregnated with a colloidal solution of one or more of the noble metals. To effect this a layer of oxide or other absorbent compound is formed on the surface of the resistor, the coating solution is then applied and subjected to heat and heavy pressure by a suitable machine.—London *Elec. Eng'ing*, June 12, 1913.

**Electrophysics and Magnetism**

*Glow Discharge from Wires.*—J. S. TOWNSEND.—The force required to produce a discharge from the surface of a wire is investigated theoretically, on the hypothesis that the conductivity of the gas is produced by the ions generated by the collisions of positive and negative ions with molecules of the gas. The case in which the discharge takes place from a wire to a large coaxial cylinder is considered, and the critical forces at the surfaces of wires of various diameters, corresponding to different pressures of the gas between the wire and the cylinder, are deduced from the sparking potentials for parallel plates at various distances apart. The forces calculated by the theory are in good agreement with experimental determinations.—London *Electrician*, June 6, 1913.

*Disintegration of Radium A.*—W. MAKOWER AND S. RUSS.—An abstract of a (British) Physical Society paper. When an atom of radium A disintegrates an alpha particle is expelled which carries with it two positive atomic charges. At the same time the radium B atom formed recoils with a single positive charge. To account for these facts it is necessary to suppose that three negative electrons are expelled during the process. If these are emitted with a high velocity, they should appear as beta rays capable of detection by the ionization they produce or by their photographic action. On the other hand, they might consist of a slowly moving delta radiation which would escape detection by either of the above methods. The experiments which were made by both methods in the hope of detecting beta rays from radium A failed to reveal any such radiation.—London *Electrician*, June 6, 1913.

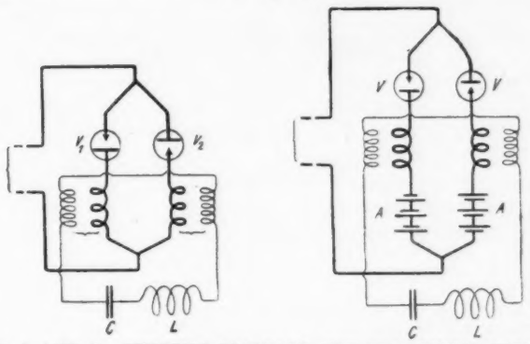
**Units, Measurements and Instruments**

*Vibrator Galvanometer Design.*—H. F. HAWORTH.—An abstract of a (British) Physical Society paper. (1) The maximum amount of power available for vibrating the moving system of a vibration galvanometer of the moving-coil type is $V^2/4R$. As the frequency of the instrument is raised the losses increase rapidly, and hence it is advantageous to be able to increase the useful power input per unit voltage. To do this the resistance of the instrument must be decreased. This can be done in a galvanometer of the Duddell type by leading the current in and out at the bottom bridge and short-circuiting the wires at the top bridge, and it results in a great increase of sensibility. A lower resistance also requires a lower flux density. (2) Owing to the losses in the moving system increasing at a greater rate than the first power of the frequency, and inasmuch as the frequency of the system increases at a lower rate than the reciprocal length of the string on account of the mass of the mirror, the flux density must be increased as the frequency increases in order that the back emf of the moving system may always be half that of the applied potential difference. As the losses are low at low frequency and the mass of the mirror is not large, then, compared with the mass of the wire, the flux density required is moderate, but at high frequencies the flux density required is large. In order to obtain this result economically it is convenient to make the depth of the poles small compared with the maximum length of the wires. This gives a sufficient field for the long wires, and for short wires one is able to obtain the necessary flux density because the total flux can still be put through the moving system. (3) A combination of (1) and (2) makes a very satisfactory instrument with a much flatter voltmeter-sensibility-frequency curve than is obtained usually.—London *Electrician*, June 6, 1913.

*Energy Losses in Condensers.*—L. W. AUSTIN.—An account of measurements of energy losses in some condensers used in high-frequency circuits at a maximum emf of 14,500 volts, this being the value frequently employed in the newer wireless sets. The losses in the compressed-air condenser used (0.00575 mf) amount, at a pressure of 15 atmospheres, to an equivalent resistance of between 0.1 ohm and 0.2 ohm. Condensers in which brushing is prevented by the nature of their construction show no change in resistance between the limits of observation, 4000 to 20,000 volts, indicating that the internal losses are independent of the voltage. Leyden jars of commercial types immersed wholly in oil show losses only slightly greater than those of the compressed-air condenser. The paper and micanite condensers tested show very much larger losses. The resistances of the different Leyden jars in air vary between 1 ohm and 1.8 ohms at 14,500 volts. Between 10,000 volts and 20,000 volts the equivalent resistance increases approximately in proportion to the square of the voltage. Placing Leyden jars in parallel series, the capacity remaining the same, does not diminish their brushing losses below 20,000 volts. Immersing only the edges of the conducting coatings of Leyden jars in oil gives an equivalent resistance midway between that when wholly in air and that when wholly in oil. Brushing losses are much increased by any semi-conducting material on the surface of the glass at the edges of the conducting coatings of Leyden jars.—*Bulletin Bureau of Standards*, Vol. IX, No. 1, 1913.

*Aluminum Valve.*—J. ZENNECK.—An article illustrated by diagrams on electrolytic cells with an aluminum electrode and a lead electrode and a 5 per cent solution of ammonia phosphate. The author emphasizes the importance of high-current densities not only during the process of formation of the cell, but also after the stationary condition has been reached. He also describes experiments made with high-frequency currents. His results show that even with frequencies of 4,000 or 10,000 cycles per second a good rectifying effect can be obtained, but that a high-current density is necessary to give a good valve effect. In order to use a high-current density cooling of the aluminum electrode is necessary and the arrangement used by the author for this purpose is described. The aluminum cell may be used for transformation of frequencies, as shown in Fig. 1 in which the condenser circuit $L$ $C$ is tuned to double the

frequency of the alternating current supplied by the machine *M*. The author's experiments show that with a frequency of 4000 and 10,000 cycles per second from the machine strong oscillations having a frequency of 8000 or 20,000 cycles per second are obtained in the condenser circuit. Fig. 2 shows a modification of the arrangement in which a direct current is superposed on the alternating




FIGS. 1 AND 2—CURRENT DIAGRAMS FOR TRANSFORMATION OF FREQUENCY

current by inserting the storage batteries *A* as shown. When the number of batteries was properly chosen the effect was considerably improved, although the current taken from the storage batteries was only about 1 milliampere.—*Phys. Zeit.*, June 15, 1913.

*Electrodynamometer for Heavy Currents.*—P. G. AGNEW.—An illustrated description of a tubular electrodynamometer for heavy currents. To obtain the same current it is usual to strand the windings of the field coils of electrodynamometers, and the strands should also be thoroughly mixed, so that all shall have the same effective resistance and inductance. For heavy currents this becomes a matter of extreme difficulty. The author describes a tubular instrument consists of two coaxial copper tubes, thus giving a circular magnetic field in the space between the tubes. On direct current the distribution may be assumed to be uniform over the cross-section of the tubes, but on alternating current the stream lines are crowded toward the outside of the inside tube and toward the inside of the outside tube, and the amount of this change depends upon the frequency. But with axial symmetry the magnetic field at any point is independent of the current distribution. Expressed in the usual terms there is no magnetic field between the tubes due to the outside tube, and that due to the inside tube is independent of the skin effect. The construction of the instrument is described and its constants and dimensions are given, together with results.—*Bulletin Bureau of Standards*, Vol. VIII, No. 4, 1913.

*Air Condensers.*—H. SCHERING AND R. SCHMIDT.—A translation in abstract of their recent German paper on the construction of air condensers at the Reichsanstalt.—London *Electrician*, May 30, 1913.

### Telegraphy, Telephony and Signals

*Mechanical Devices to Assist Manual Operation of Telephone Exchanges.*—W. SLINGO.—A paper read at the joint meeting of the (British) Institute of Electrical Engineers and the Société Internationale des Electriciens in Paris. Apparatus by which operators can be assisted in dealing with the traffic of the ordinary manual telephone exchanges are described in detail. These include traffic distribution, call-wire selectors and alarm signals. On groups of outgoing call-wires between very busy exchanges much trouble has been experienced as a result of confusion during busy periods owing to one operator interrupting another in their desire to dispose of the traffic and delay experienced by the A operators in finding a slack call-wire at such periods. An automatic call-wire selecting equipment has been installed at the Central Exchange, London, which has for its object the selection and isolation of a call-wire when one

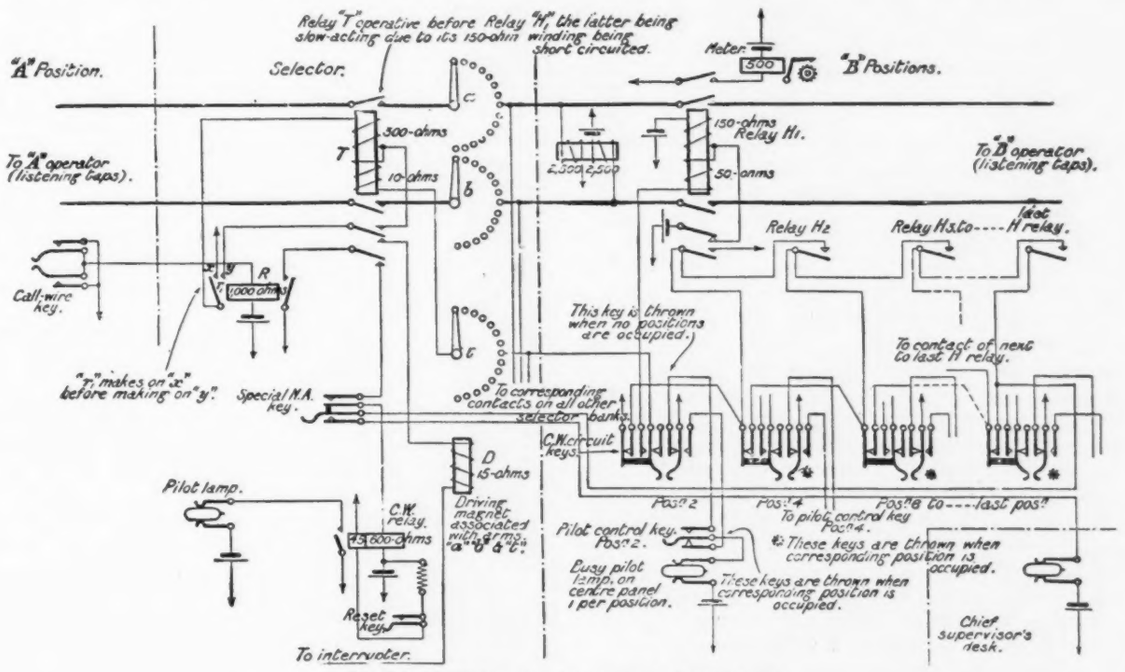

Relay "T" operative before Relay "H", the latter being slow-acting due to its 150-ohm winding being short circuited.
"A" Position.
Selector.
Meter.
500
"B" Positions.
300-ohms
T
10-ohms
150-ohms Relay H1.
50-ohms
To "A" operator (listening taps).
To "B" operator (listening taps).
Relay H2
Relay H3 to ---- last H relay.
Call-wire key.
1000 ohms
This key is thrown when no positions are occupied.
To contact of next to last H relay.
"T" makes on "x" before making on "y".
Special M.A. key.
To corresponding contacts on all other selector banks.
C.W. circuit keys.
D
15-ohms
Pilot lamp.
C.W. relay.
600-ohms
Driving magnet associated with arms "a" "b" & "c".
Pos.2
Pos.4
Pos.6 to --- last pos.
To pilot control key Pos.4.
Pilot control key. Pos.2.
These keys are thrown when corresponding position is occupied.
Busy pilot lamp, on centre panel 1 per position.
These keys are thrown when corresponding position is occupied.
Reset key.
To interruptor.
Chief supervisor's desk.

FIG. 3—DETAILS OF SELECTIVE MECHANISM

electrodynamometer in which an entirely different means of obtaining the same end is employed. Evidently the ultimate requisite in an instrument for transferring from alternating to direct current is that the torque shall be the same, and it is immaterial whether we make the current distribution the same or the field due to the current the same. The latter is the method adopted. The field "coil" of the

is required by an A operator. There are 10 call-wires in the group affected, which, before the introduction of the new conditions, were operated from 10 call-wire keys, the circuits of which were multipled over 160 A positions. When the selecting equipment was introduced the ten keys per position were replaced by one key per position. Each operator is given a selector which rotates when she de-

presses her call-wire key. The rotation continues until the wipers find an idle B operator, when the A operator is able to pass her call. More than one A operator cannot obtain connection with the same B operator at the same time. A click is heard in the A operator's receiver when a disengaged call-wire is obtained. A lamp located on the chief supervisor's desk glows when all the accessible B positions are simultaneously engaged with traffic passing over the call-wires. The continued glowing of this lamp will indicate that delay is being occasioned, the A operators having difficulty in finding a free B operator, and that, therefore, additional B positions should be staffed to cope efficiently with the traffic. The details of the selective mechanism are shown in Fig. 3. Each A position is provided with a selector, and each selector has associated with it two relays, an R relay and a T relay. The contact banks of the selectors are multipled together and are connected to the group of B positions, so that each B position is represented on each bank by a separate set of contacts. With each B position there is associated an H relay and a retardation coil. The *a* and *b* arms of the selectors are connected with the A operator's telephone circuits through contacts of the associated T relays, and the selector bank contacts are connected with the B operator's telephone circuits through contacts of the H relays. On the depression of a call-wire key by an A operator, the arms of that selector which corresponds to the particular position concerned commence to seek over the contact bank, and automatically come to rest on the contacts of the first accessible and disengaged B position. The T relay associated with the A position and the H relay associated with the B position are now operated, so that the two speaking circuits are connected. On the release of the call-wire key on the A position the selector arms do not move from the position occupied. The T and H relays are, however, released, and disconnect the A operator's telephone circuit from the B operator's circuit. During the time the call-wire is in use the T relays remain operated, and this renders the multiple contacts on the particular B position engaged against the other selectors by reducing the potential on the *t* contacts from 22 volts to nearly earth potential. The T relays of other selectors whose arms may pass over these contacts, therefore, will not be operated. When a B position is rendered inaccessible to the selectors by the B position call-wire key being normal, the battery is disconnected from the *t* contacts corresponding to the position so that in this case also the T relays of searching selectors will not be operated. Motor interrupters are used for supplying the interrupted current to drive the selectors.—London *Electrician*, June 13, 1913.

### Miscellaneous

*Lightning Rods.*—S. Ruppel.—A report to be presented at the annual convention of the German Association of Electrical Engineers on the protection of buildings against lightning. The author emphasizes that there are still many regulations concerning lightning rods in existence which make their construction and maintenance difficult. For this reason the number of buildings provided with lightning rods is still small, and this is especially true in agricultural districts. Since 93 per cent of all the damage done by lightning occurs in agricultural districts, lightning rods should be provided there. The largest part of the damage done—about 92 per cent—is due to fires caused by lightning which could have been prevented by very simple lightning rods. Simple lightning rods could be constructed anywhere if the rules of the Berlin Electrical Society were followed. Municipalities should erect them. *Elek. Zeit.*, June 5, 1913.

*Electric Shock.*—J. P. Langlois.—A long discussion on accidents by electric shock and electric execution, dealing especially with the effect of the voltage, the current, the resistance of the body, the time of contact, the position of the electrodes, the frequency, etc. Notes are added on the treatment and the revival of people suffering from electric shock.—*Revue Gén. des Sciences*, April 30, 1913 (abstracted in *La Lumière Elec.*, May 31, 1913).

*Kareis.*—An obituary notice of Josef Kareis, one of the founders and the first secretary of the Electrical Society of Vienna.—*Elek. und Masch.* (Vienna), June 1, 1913.

# Book Reviews

Wiring Diagrams of Electrical Apparatus and Installations. New York: McGraw-Hill Publishing Company. 439 diagrams. 254 pages. Price, $2.

A collection of circuit diagrams, taken from actual practice, representing more or less completely all branches of the electrical art except telephony and telegraphy. Armature winding is not included, as the publishers state that it would occupy too much space. Obviously the material has been gathered almost entirely from manufacturers' bulletins, but it embraces in a single publication drawings obtained from a large number of sources. The subjects covered are generators, feeders, transformers, regulators, converters, batteries, boosters, substations, motors, motor control, distribution, lamp mechanisms, rheostats, controllers, arresters, instruments, circuit-breakers, railway signals and interior wiring. The drawings almost without exception are clear and distinct. Where they are not entirely self-explanatory a brief text is added. This volume should be of considerable service to the practising electrical engineer.

La Télégraphie et la Téléphonie Simultanées et la Téléphone Multiple. By K. Berger. Translated into French by P. Le Normand. Paris: Gauthier-Villars. 134 pages, 111 illus. Price, 4.5 francs.

A treatise on simultaneous telegraphy and telephony as well as on multiple telephony, from the standpoint of the engineer. The presentation is according to the telegraph-telephone systems of the German government. A very brief historical sketch of the subject is given in the introduction. The work is then divided into two sections, namely, (1) simultaneous telegraphy and telephony, (2) multiple telephony, or simultaneous multiple telephonic conversation over a circuit or group of circuits, with special reference to phantom circuits. Various arrangements which have been developed in America are not referred to in the book, which is confined to German systems. The treatment is very practical and detailed, however, with respect to those systems. The book will recommend itself to telegraph and telephone engineers interested in European systems.

Book of Standards. 1913. National Tube Company, Pittsburgh, Pa. 559 pages, illus. Price, $2.

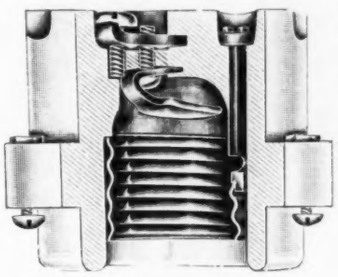
This volume contains tables and useful information pertaining to tubular goods as manufactured by the National Tube Company. It is got up in regular handbook style, the mechanical work being excellent. Besides a great many practical data on piping and tubing for all uses, there are 140 pages on tubular wrought-steel poles; also data on tubular columns, tubular and solid beams, flow and measurement of water, physical properties and flow of gases, steam and air, tables of the properties of tubes and bars, and conversion tables. Other useful features are a glossary of terms used in the pipe and fitting trade and an extended list of definitions. The volume is well indexed. One of the commendable features is the practice of giving the source or authority for the engineering data presented. Altogether this makes a very handy volume for the engineer who needs data on piping or tubing more or less frequently in his work.

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## Receptacle Socket

A new receptacle illustrated herewith has been brought out by the Chi-Ill-Electric Company, 5124 North Ashland Avenue, Chicago. It consists of a porcelain receptacle and a galvanized-steel conduit-box cover made in 3-in. and 4-in. sizes to fit all standard conduit boxes. A yoke is placed under the shoulder of the porcelain receptacle, clamping the steel cover to the porcelain and also acting as a reinforcement to the latter. A brass finishing cover is placed over and fastened to the steel cover.



RECEPTACLE SOCKET

The screw shell is fastened to the porcelain by means of legs to which the shell is riveted. These legs extend through the porcelain and are connected to riveted and soldered contacts on the back of the socket. Other types of receptacles are made without the galvanized-steel cover and without the finishing plate, a plain polished brass cover taking the place of the steel cover and finishing plate. Plain brass plates are made in 3-in. and 4-in. sizes to fit standard outlet boxes.

A valuable feature characterizing the Chi-Ill socket is the distance that is provided between the polarities. The contacts of the device are so arranged as to give easy access to the wiring.

## All-Porcelain Socket

In the all-porcelain socket shown in the accompanying illustration a quick make-and-break switch mechanism is used, which accounts in part for the high 660-watt, 250-volt rating secured. This switch is smaller than the socket which it supersedes, and is easier to install. The casing consists of two halves, to one of which the mechanism is permanently attached. To wire the socket only one screw need be removed, allowing the halves to be separated. This makes accessible the two binding screws to which the cord is attached. A reducing bushing for the cord is supplied and provision made for standard-socket shade holders. The indicating operating bar is situated where the thumb and finger are naturally placed when grasping the socket. As the push-bar is in a horizontal plane, the socket is not twisted or jarred when operated, and only one hand is required.

PORCELAIN SOCKET

The 660-watt rating makes this push-button socket particularly suited for use with heating and cooking appliances and small motor-driven devices. As there is also a demand for a porcelain socket of this kind for fixture work, it is understood that the manufacturer, the Cutler-Hammer Manufacturing Company, of Milwaukee, contemplates the marketing of such a model with 0.125 in., 0.25 in. and 0.375 in. brass nozzles.

## Motor-Driven Typewriter

The motor-driven typewriter and adding machine, illustrated herewith, is manufactured by the Crawley Company, 185 Madison Avenue, New York City. Although it is driven by an electric motor contained within the case, the entire action is purely mechanical, and in this respect the machine differs widely from all previous attempts to produce an electric typewriter, as there are no contacts to be made and broken. The motor runs continuously, driving a belt, which belt in turn drives a jack-shaft to which the type-bar operating mechanism is attached. The carriage throw-back, line space and adding mechanism (which last named is contained in the same case) are all likewise electrically driven.

MOTOR-DRIVEN TYPEWRITER

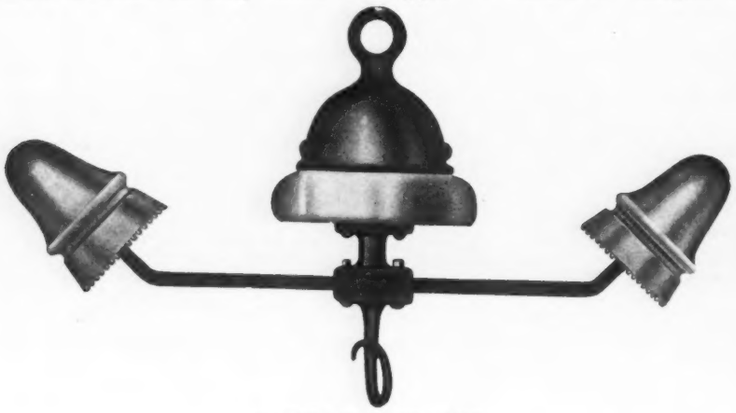
The idea has been, as the manufacturers point out, to supply electrical energy, which is cheap, to take the place of human energy, which is costly. It is estimated that on the Crawley electric typewriter the stenographer annually saves some 300 miles in distance traveled by her fingers, to say nothing of the energy conserved. This is due to the fact that the type-bar action is virtually set on a "hair-trigger" like an automatic gun or like a linotype machine and the depression of the keys is but 3/16 in. as compared to 5/8 in. on the manually operated typewriter.

An additional feature is found in the small lever on the side of the machine by which the tension on the actuating spring may be strengthened, thus making the blow of the type harder for carbon work.

The motor is of a special type designed and manufactured by the Westinghouse Electric & Manufacturing Company after considerable investigation and exhaustive testing of the machine.

## Arc-Lamp Hanger

The important feature of the arc-lamp hanger recently brought out by the Line Material Company of South Milwaukee, Wis., lies in the fact that even though the insulator be broken the lamp cannot be dropped. A transverse



HANGER FOR ARC LAMP

3/8-in. rivet, which passes under a malleable-iron yoke connecting two vertical bolts, blocks the fall of the yoke to which the pigtail lamp hook is secured. It is stated that the insulation will resist a pressure of 20,000 volts.

## Portable Phase-Rotation Indicator

When installing polyphase motors, generators, meters, etc., it is frequently found that the direction of rotation is reversed owing to the transposing of windings or leads which cause incorrect phase rotation. This is especially true when motors or meters are connected up by the construction men, who frequently find it necessary to reverse leads and cables.

Changes in shop or distribution circuits causing accidental reversal of phase may cause serious damage if the men installing the equipment do not check out the phase position. The process of confirming these positions is somewhat difficult for the ordinary man to understand, as it involves the use of complicated connections and phasing lamps. When it is absolutely necessary to have motors start in the correct direction, such as on presses, elevators and certain shop tools, it is essential that the phase rotation be predetermined.

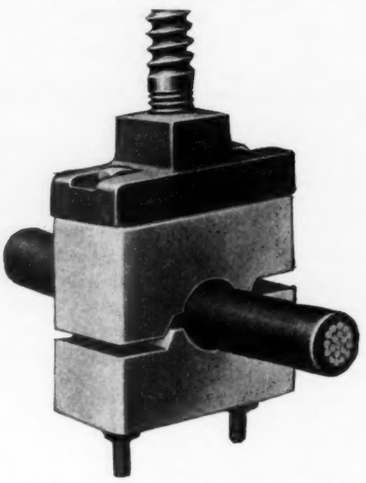
The portable phase-rotation indicator illustrated here-

INSTRUMENT FOR DETERMINING PHASE POSITION

with indicates on the dial the phase position in polyphase circuits. Its connection to the circuit requires no more experience than is necessary to connect up a voltmeter. Deflection of the pointer to the right or left indicates the phase position, enabling the correct installation of equipment initially. This indicating instrument is manufactured by the Delta-Star Electric Company, Chicago, Ill.

## Cable Hanger for Mine Service

A cable hanger to facilitate the hanging of feeders in mines has recently been placed on the market by the Electric Service Supplies Company, of Philadelphia, Pa. These hangers are designed for holding cable of from 0.5 in. to



CABLE HANGER WITH CABLE IN PLACE

1 in. in diameter inclusive and permit the placing or removal of the cable after the hanger has been permanently installed. As shown in the illustration the hanger consists of two split porcelain insulators notched and fitted together to receive the cable. The porcelain insulators are fastened together with bolts extending through the cast-iron head. The clamping surface of the insulators is ribbed to prevent any tendency of the cable to slip through the clamp and damage the insulation. These hangers, which are 3.25 in. wide and 4.5 in. high, are supported by galvanized lag-screws or expansion bolts.

## Compact Turbo-Generator for Marine Use

Certain classes of marine service demand electric generators of high efficiency with minimized weight and dimensions. This class is perhaps best represented by the United States torpedo-boat destroyers, in which space and other important features are sacrificed in favor of high speed.

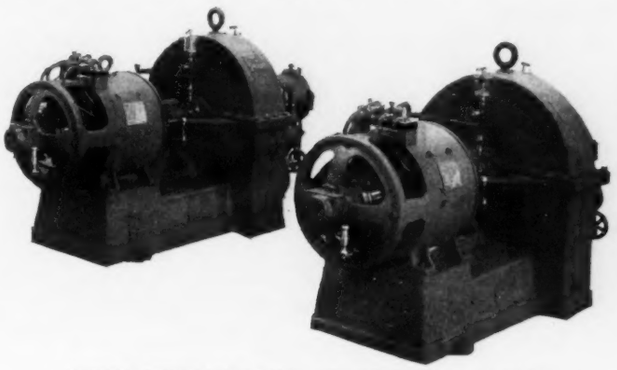
The accompanying illustration shows two turbine-driven generators recently supplied in accordance with naval requirements for destroyers. These machines are

TABLE I—RESULTS OF HEAT-RUN TESTS

| Thermometer Position | Temp. Deg. C. After Four-hour Full-Load Run | Temp. Deg. C. After Two-Hour One-Third-Overload Run |
|---|---|---|
| Armature | 22.5 | 24.5 |
| Commutator | 21.5 | 25.0 |
| Shunt field | 21.0 | 21.5 |
| Interpole coil | 17.5 | 20.0 |
| Bearing | 30.5 | 25.0 |
| Field rheostat | 30.5 | 25.0 |

rated at 10 kw, 125 volts and 3600 r.p.m., take steam at 200 lb. pressure, and are designed to exhaust against any pressure from that of 26 in. of vacuum to 3-lb. back pressure. It is stated that the maximum steam consumption under these conditions is 53.8 lb. per kw-hr. at full load. When tested for voltage regulation these sets showed a maximum variation of 2 volts between no load

and full load. Table I shows the temperature rise in degrees Centigrade in different parts of the machine. The temperatures in the first column were taken after a four-hour full-load run, and those in the second column after two hours' operation at 33⅓ per cent overload. The



TURBO-GENERATOR SETS FOR DESTROYER SERVICE

temperature of the surrounding air was constant at 25 deg. C.

Table II sets forth some interesting facts regarding the rough usage and heavy fluctuating loads to which these

TABLE II—GOVERNOR REGULATION

| Load Variation | Steam Pressure in Pounds, Condensing | Steam Pressure in Pounds, Non-condensing | Maximum Variation, per Cent |
|---|---|---|---|
| 90 per cent to no load | .... | 160 | 1.1 |
| No load to 95 per cent | .... | 160 | 1.78 |
| Full load to no load | .... | 200 | 1.1 |
| No load to full load | .... | 200 | 1.9 |
| Full load to no load | 200 | .... | 2.5 |
| No load to full load | 200 | .... | 1.4 |
| Full load to 20 per cent load | 200 | .... | 0.8 |
| 20 per cent load to full load | 200 | .... | 1.6 |

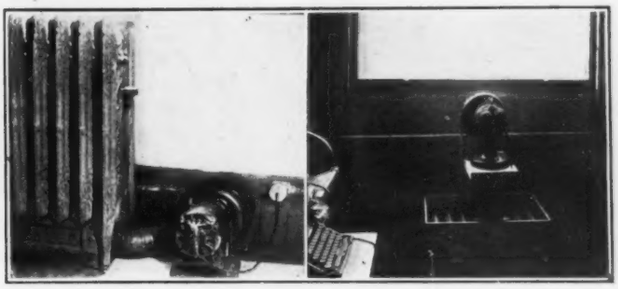
sets may be subjected and still remain within the specified limits of voltage regulation. The net weight of the set is 1350 lb. The generator was built by the Diehl Manufacturing Company, of Elizabeth, N. J., and the turbine by the Terry Steam Turbine Company, of Hartford, Conn.

## Motor-Driven Blowers for Ventilating

It is said that every grown person needs 3600 cu. ft. of fresh air every hour, and without this amount may suffer lowered vitality and reduced efficiency for accurate work.

In the accompanying illustrations are shown two applications of motor-driven blowers for office ventilation. In the Pennsylvania Railroad station at Pittsburgh the ventilating problem was solved economically by installing in each office a small motor-driven ventilating set such as the one seen in Fig 1. The set is placed on the floor near the radiator and draws in fresh air through the existing ducts, forcing it out through the radiator and thus filling the room with fresh warm air. Electrical energy to drive the motor is obtained from the lighting circuit. Some of the inside offices use these sets in summer as well as in winter.

Another type of installation, shown in Fig. 2, has been found convenient in the winter. In this installation a small motor-driven blower is arranged with a few pieces of piping so that fresh air is drawn from the outside and delivered against a steam-heated radiator. The intake of the blower is piped with a gate between it and the board set in the window to give access to the outside air, the blower outlet delivering the air at the top of the radiator. The air is prevented from blowing along the floor by a galvanized-iron box which surrounds the radiator on all four sides, extending from the floor to the top of the radiator. Thus the cold air is delivered at the top of the radiator in a



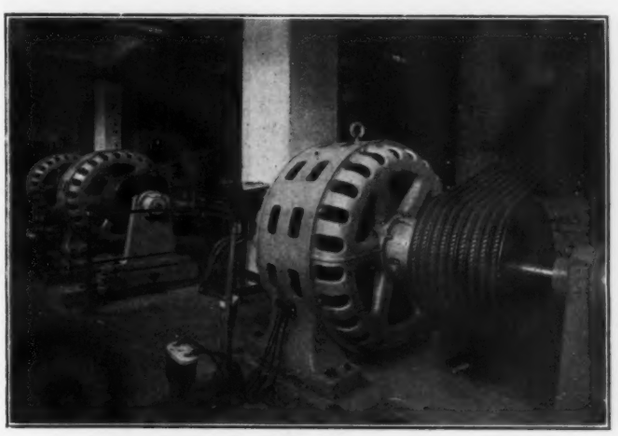
FIGS. 1 AND 2—TWO SCHEMES FOR VENTILATING OFFICES

downward current, and before it can find its way out of the box again it must rise around the radiator and become warmed. The blower shown is capable of furnishing 175 cu. ft. of air per minute, a sufficient supply for three persons. The Sirocco blowers shown in both of these installations are driven by Westinghouse motors.

## A Motor-Driven Ice and Cold-Storage Plant

The Diamond Ice Company, Seattle, Wash., which uses electric-motor drive for all its machinery, has a refrigeration equipment rated at 195 tons per twenty-four hours. One-third of this rating is used for cold storage and the remainder for the manufacture of ice. The ammonia direct-expansion system is used, and the ice is made in plates 17½ ft. by 8½ ft. by 1 ft., tank space being provided for making ninety-six such plates.

The illustration shows three 125-hp Westinghouse induction motors, each driving a 65-ton Wolfe-Rinde ammonia compressor. In addition to these, there are in use also two 4-hp motors operating cranes for raising ice from the tanks, two 7.5-hp motors on hoists above the cranes, two 4-hp motors for the tipping mechanism which handles the



MOTOR-DRIVEN ICE AND COLD-STORAGE PLANT

ice to the sawing tables, one 4-hp motor on the saw, one 2-hp motor on a 45-ft. conveyor which raises the ice 5 ft. to the storage room, one 0.5-hp motor driving the overflow pump, one 1.5-hp motor driving the air-compressor for agitating the water in the tanks and one 15-hp motor for driving a 2-ton elevator which serves four floors.

The energy consumed by these motors last year for the

dates indicated was as follows: Compressor motors—May 20 to Aug. 23, 399,744 kw-hr.; Aug. 23 to Sept. 27, 143,968 kw-hr.; Sept. 27 to Oct. 23, 123,712 kw-hr.; Oct. 23 to Nov. 22, 52,096 kw-hr. Auxiliary motors—July 16 to Aug. 22, 4668 kw-hr.; Aug. 22 to Sept. 24, 4204 kw-hr.; July 16 to Oct. 23, 3887 kw-hr.; Oct. 23 to Nov. 22, 3638 kw-hr.

## Results of Horizontal Illumination Survey

Tests made by Messrs. A. L. Avenberg and R. E. Fischel of the Armour Institute of Technology at Chicago in order to determine the efficiency of the system of indirect illumination installed there have brought out interesting data. The room was 14.5 ft. in height, 23 ft. in width and a little more than 27.5 ft. in length. The ceiling of the

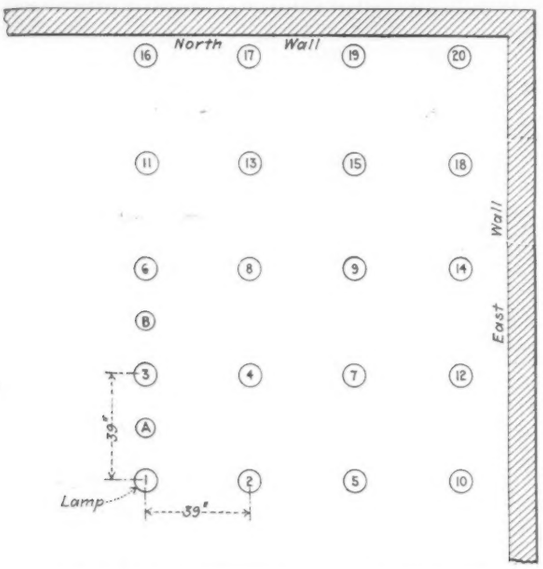



FIG. 1—LAMP POSITION AND TEST STATIONS

room was finished in cream white and the walls were of a dark tan color. A corner of the room showing the arrangement of the test stations and the position of the lamp is shown in an accompanying illustration. The survey was confined to this corner of the room and readings were taken

TABLE I—DATA TAKEN WITH REFLECTOR

| Station Number | Average Observed Intensity, Ft.-candles | Average Voltage | Corrected Intensity (112-Volt Basis) |
|---|---|---|---|
| 1 | 3.54 | 113.0 | 3.41 |
| 2 | 3.30 | 113.2 | 3.16 |
| 3 | 3.36 | 113.6 | 3.17 |
| 4 | 2.85 | 111.7 | 2.89 |
| 5 | 2.48 | 112.5 | 2.44 |
| 6 | 2.38 | 112.5 | 2.34 |
| 7 | 2.15 | 112.0 | 2.15 |
| 8 | 2.20 | 112.8 | 2.15 |
| 9 | 1.74 | 111.2 | 1.79 |
| 10 | 1.69 | 113.1 | 1.62 |
| 11 | 1.59 | 113.4 | 1.51 |
| 12 | 1.56 | 113.0 | 1.50 |
| 13 | 1.43 | 113.0 | 1.38 |
| 14 | 1.25 | 113.0 | 1.21 |
| 15 | 1.19 | 113.1 | 1.15 |
| 16 | 1.03 | 112.0 | 1.03 |
| 17 | 0.98 | 112.0 | 0.98 |
| 18 | 0.99 | 113.0 | 0.95 |
| 19 | 0.81 | 112.0 | 0.81 |
| 20 | 0.58 | 112.7 | 0.57 |
| A | 3.48 | 113.3 | 3.31 |

from the different stations as shown in the data of Tables I, II, and III.

The lighting unit employed in all of the tests was a 500-watt spherical tungsten lamp, and in the first and third tests a 24-in. Alexalite diffuser furnished by the Central Electric Company of Chicago was interposed to provide the indirect illumination. All readings were taken with a Sharp and Millar photometer.

In the first test, the results of which are given in Table I, the working plane was taken 31 in. above the floor and readings were taken consecutively for each station as

TABLE II—DATA TAKEN WITHOUT REFLECTOR

| Station Number | Average Observed Intensity, Ft.-candles | Average Voltage | Corrected Intensity (112-Volt Basis) |
|---|---|---|---|
| 1 | 3.48 | 112.8 | 3.40 |
| 3 | 4.32 | 112.5 | 4.25 |
| 6 | 3.90 | 112.2 | 3.87 |
| 11 | 2.78 | 112.8 | 2.71 |
| 16 | 1.706 | 113.0 | 1.65 |
| 20 | 1.170 | 112.0 | 1.170 |
| B | 4.160 | 112.3 | 4.100 |

shown by the data. The average observed intensity was later corrected on a 112-volt basis to facilitate comparison. The average intensity was found to be 1.74 ft.-candles on the working plane, and with an available 1105 lumens as the effective flux, the number of lumens per watt on the working plane was 2.17.

The second test was made with the bare tungsten lamp and with the working plane as before, 31 in. above the floor. The results of this test are given in Table II, and comparison of the direct and indirect lighting is drawn in the

TABLE III—EFFECT OF VARYING HEIGHT OF WORKING PLANE

| Station Number | Height of Working Plane, in Inches | Intensity, Ft.-candles |
|---|---|---|
| 1 | 31 | 3.41 |
| 3 | 31 | 3.17 |
| 1 | 76 | 7.70 |
| 3 | 76 | 6.00 |
| 1 | 117 | 15.00 |
| 3 | 117 | 11.00 |

curves presented in Fig. 2. The results given in Table III show the effect of varying the height of the working plane when the lamp is fitted with the same diffuser used in the first test.

Interesting facts are brought out by a comparison of the results shown in Tables I and II. By consulting data or curves it may be seen that the intensity of the illumination

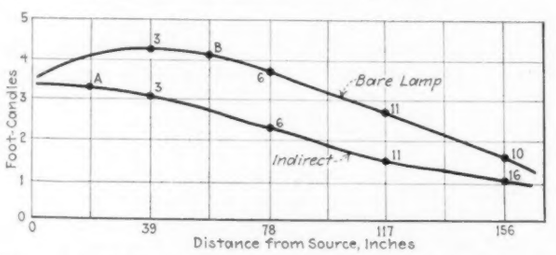



FIG. 2—COMPARISON OF DIRECT AND INDIRECT LIGHTING

directly beneath the unit is the same with the diffuser interposed as it is with the bare lamp. With this system of indirect lighting the brightest point in the room is directly beneath the unit, the intensity dropping off as the test stations recede from the center of the room. It would seem at a glance that there should be a dark spot beneath the unit, but the results show that this is not the case.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Electrical Heating Specialties Exported.**—The William E. Slaughter Company, of 1712 Michigan Avenue, Chicago, Ill., manufacturer of the Schwartz line of electrical specialities, states that a large shipment of these heating devices has just been sent to South America. The company will shortly put on the market a new electric curling iron.

**Transformer Orders Continue Good.**—Advices come from the Moloney Electric Company, of St. Louis, Mo., manufacturer of transformers, that both its Canadian and its St. Louis factory are well supplied with orders and are working about four nights a week. The company says that the business booked at this date is about three times the amount booked at the corresponding date last year.

**Rehabilitating Rotten Poles.**—A brief note of general interest comes from the Illinois Electric Company, of Chicago, Ill., in which it says: "Our sales force finds that the Orr process of pole reinforcement is rapidly increasing in popularity. This method of repairing butt-rotten poles is being adopted by many of the larger telephone and electric light companies and is fast coming into general use."

**Rheostats for Battery-Charging Switchboards.**—The Fashion Automobile Station, at 4610 Cottage Grove Avenue, Chicago, Ill., has recently installed two new battery-charging boards, the first of which was equipped with thirty circuits and the second with forty-five circuits. Compression-type resistance rheostats made by the Allen-Bradley Company, of Milwaukee, Wis., were used throughout this installation.

**Insulator Company Enlarges Its Plant.**—The Pittsburgh High-Voltage Insulator Company, of Derry, Pa., writes as follows: "The demand for our product has made necessary the building of additional kilns and the increasing of our floor space. We have one new kiln completed and in operation and two more in process of erection. A new building measuring 90 ft. by 200 ft. has been completed and work has been started on another building 40 ft. by 540 ft. in size."

**Paint Factory Buys Equipment.**—The James Clark, Jr., Electric Company, of Louisville, Ky., recently sold to the Chicago White Lead & Oil Company seven motors for use in the paint and lead factory of the latter company, these motors ranging in size from 10 hp to 50 hp. The same company will furnish the electrical equipment to be installed by the Eminence Distillery Company, of Eminence, Ky., consisting of an engine and generator, with a number of motors.

**Motor Drive for Veneer Mills.**—The Astoria Veneer Mills & Dock Company, of Long Island City, N. Y., is installing a 360-hp De Laval mixed-pressure steam turbine driving an Allis-Chalmers 240-kva alternator. Two motors of the latter make are already ordered, one of 60-hp and another of 7½-hp rating, which will be used for driving veneer-making machinery. The generating unit has ample capacity to care for future additions to the drive equipment. A 500-amp Krantz switchboard is also to be supplied for this installation.

**Fixture Business Has Excellent Outlook.**—According to the Philadelphia Electrical & Manufacturing Company, the business outlook in its line for the summer months is excellent. A contract has just been closed with the Albany & Northern Railway Company, at Albany, N. Y., for 900 sets of street-lighting fixtures to be used on ornamental iron poles. Announcement is also made of the fact that new price lists, Nos. 18, 19, and 20, are just out, covering street-lighting fixtures, tungsten arc lamps, lighting standards and line material only.

**Pittsburgh Company Growing.**—Word is received from the Elliott Company, of Pittsburgh, Pa., to the effect that the increase in its business has been so rapid as to render its present quarters entirely inadequate. To meet the extra requirements this company has purchased the 33 acres and plant at Jeannette, Pa., owned formerly by the Clifford Cappel Fan Company. By this purchase the Elliott Company will secure about 2½ acres of additional floor space, and it is expected that the new plant will be thoroughly overhauled and modernized and ready for operation by the first of October.

**Testing Batteries in Demand.**—The testing batteries manufactured by E. Marcuson, of 136 Liberty Street, New York, are now being used not only as portable outfits but also in laboratories in connection with cable-testing sets. They have been improved recently, as noted in the *Electrical World* of June 28, by the addition of a new form of commutating switch, which has been devised for obtaining various voltages at the terminals. Orders for these testing batteries have recently been received from the Edison Electric Illuminating Company, of Boston, Mass.; Rensselaer Polytechnic Institute, Troy, N. Y.; United States Signal Corps; Waterbury Company, of New York, and others.

**Activity of the Wire Inspection Bureau.**—Reports from the Wire Inspection Bureau, 80 Maiden Lane, New York, indicate that a considerable quantity of copper-steel wire and a fair amount of railway signal and transmission line wire are being inspected; also moderate quantities of high voltage isulators, steel towers and hydroelectric machinery, much of the work on the latter two items being for the government. The bureau is introducing a system for the purchase of high-grade rubber-covered wire to individual specifications and taking into consideration the manufacturer's reputation, with an inspection service that includes not only the regular factory inspection but also a series of follow-up and identification tests. It is stated that this plan is operating successfully.

**Generating Apparatus for Private Estate.**—Fairbanks, Morse & Company, of 30 Church Street, New York, are supplying a 15-hp gasoline engine directly connected to a 10-kw direct-current generator for use on the estate of Walter Williams, at Montclair, N. J. The energy supplied will be used for illuminating and for operating air compressors, the latter in turn furnishing air for pumping in connection with a large artificial lake on the estate. The Electric Storage Battery Company, of Philadelphia, is supplying the storage battery set, which consists of sixty-two "chloride accumulator" cells and eight counter-electromotive-force elements with auxiliaries, and is known as its standard Type A 110-volt isolated-plant equipment. The switchboard is being furnished by the Trumbull Electric Manufacturing Company, of Plainville, Conn.

**Several Companies Install Waterwheels.**—Forty vertical turbine units are being built by the Camden Waterwheel Works, of Camden, N. Y., for installation on the New York State Barge Canal, and the same company is building the headgates for the locks on this canal. The turbines are to be directly connected to generators of the same type and will be controlled by the Lombard governors, made by the Lombard Governor Company, of Ashland, Mass. The energy generated will be supplied to the motors which operate the lock gates, and also to the lamps along the canal. In addition to the above units, this company is at present furnishing a 2500-hp horizontal turbine to the Rochester (N. Y.) Railway & Light Company (to be directly connected to a generator), a quadruplex unit and a dupiex unit to the St. Regis Paper Company, of Watertown, N. Y., and one duplex unit to the Taggart Brothers Company, of the same place.

**Supply Dealers and Central Stations of Louisville, Ky., Co-operate.**—Considerable dissatisfaction has been aroused among the smaller supply dealers of Louisville, Ky., in past years by the practice of the Louisville Lighting Company and the Kentucky Electric Company of selling fans and lamps at cut prices through the elaborate and expensive appliance departments which they maintained. The above companies are shortly to be merged into the Louisville Gas & Electric Company, which will control and operate the public utilities of Louisville. This new concern will not compete with local dealers for the appliance business, but will simply carry samples and take orders for them, which will be turned over to the dealers, according to a plan arranged by a conference between the dealers and the officers of the company.

**Fairbanks-Morse Electrical Equipment for Carborundum Works.**—Additional electric generating and drive equipment is to be installed at the plant of the Massasoit Company, of Chester, Mass. This will consist of a four-valve engine, of Fitchburg Steam Engine Company make, directly connected to a 125-kva Fairbanks-Morse alternator, which will supply energy to six motors of the latter company's manufacture, ranging in size from 10 hp to 50 hp. This apparatus will furnish power for driving machinery in a new extension to the present plant, 500 ft. by 60 ft. in dimensions and three stories in height. A 600-amp switchboard is being furnished for the same installation by the Condit Electrical Manufacturing Company, of Boston, Mass., and there is to be an extra panel for motor circuits. Weston Model 24 instruments are to be installed on the switchboard. The wiring is to be placed in exposed conduits.

**Lock-Gate and Valve-Operating Mechanisms Supplied.**—In addition to the contract held jointly with the Hyde Windlass Company, of Bath, Me., for supplying gate and valve-operating mechanisms for the New York State Barge Canal work (mentioned in the June 21 issue of the *Electrical World*), the Wheeling Mold & Foundry Company, of Wheeling, W. Va., sends word that it has just finished some big government work of a similar nature. It recently completed the delivery at the Isthmus of Panama of ninety-two miter-gate-moving machines, 118 rising-stem gate-valve-operating mechanisms and forty-five miter-gate forcing machines, all electrically driven and comprising, aside from the electrical equipment, the entire operating mechanism of the Panama Canal locks. At present the company is making the steel castings for ninety towing locomotives for use at the canal. For these the General Electric Company is supplying the electrical equipment.

**Stage and Auditorium Lighting Apparatus Selling Well.**—From the Universal Electric Stage Lighting Company (Kliegl Brothers), of 240 West Fiftieth Street, New York, an optimistic statement is received concerning their business outlook. They say: "Although most theaters are now closed for the summer, we are unusually active and are furnishing material for two new local theaters, the Shubert and the Ames Gotham, as well as for the Toronto (Canada) Theater. A number of shipments of theatrical appliances have been made by us recently to Australia, in preparation for the coming season. The outlook is extremely bright. We have lately supplied apparatus to the Albany (N. Y.) High School, including border lamps and a curved footlight, 40 ft. long and wired for 192 lamps in three colors. This footlight is of the disappearing type, resting beneath the floor level and covered with temporary flooring for ordinary occasions, and being raised for special entertainments to a height of 7 in. above the floor level, in order to allow the light to spread evenly at the performers' feet and at the back drop. Several hundred feet of concealed lighting strips were used in this auditorium."

**Toledo Utility Company Increasing Its Equipment.**—From the Toledo Railways & Light Company comes the following letter relative to the installation of new equipment of various kinds at its plant: "We are installing a 12,500-kw horizontal Curtis Rateau steam turbo-generator set, together with five 660-hp Stirling water-tube boilers (supplied by the Babcock & Wilcox Company and noted in the June 21 issue of the *Electrical World*), one additional 250-ft. steel stack, 15 ft. in diameter, and a 1500-kw Westinghouse frequency-changer set, 25-60 cycle. We are contemplating the installation of a 2000-kw, three-wire direct-current motor-generator set, 25 cycles on the alternating-current side. A radial brick chimney 200 ft. high and 12 ft. in diameter is being built at our Detroit Avenue station by the Kellogg company. Several transforming substations are in process of erection, ranging from 300 kw to 1500 kw capacity, for use in supplying new energy consumers. Work will start shortly on a 33,000-volt transmission line, which will extend completely around the city of Toledo, to supply energy to the industries in the outlying districts. From this high-tension power belt energy will also be drawn for operating the interurban railways."

**Sturtevant Economizers in Wide Demand.**—An economizer shipment of unusual size and interest was recently made to the Commonwealth Edison Company, of Chicago, by the B. F. Sturtevant Company, of Hyde Park, Mass. These economizers are for use on unit No. 12 at the Fiske Street station and will be installed in four sections, one for each boiler. Induced draft will be provided by four No. 14 Sturtevant Multivane exhaust fans equipped with water-cooled bearings and directly connected to 75-hp induction motors. The fans discharge into a stack 19 ft. in diameter and 260 ft. high above the boiler-room floor. Each boiler contains 12,260 sq. ft. of heating surface and 3000 sq. ft. of superheating surface. The boilers are equipped with two chain-grade stokers containing 136 sq. ft. of surface each. Each boiler is capable of evaporating a maximum of 80,000 lb. of water per hour, with feed water at 250 deg. Fahr., into steam at 210 lb. pressure, 225 deg. superheat. About 13,000 lb. of Illinois slack coal will be burned per hour. Among the other companies which have recently ordered Sturtevant economizers are the Cleveland Electric Illuminating Company, of Cleveland, Ohio; the Southern California Edison Company, of Los Angeles, Cal.; the Delaware & Hudson Railroad Company, and the Rochester (N. Y.) Electric Light Company, to which concerns shipments aggregating 31,200 hp have been made.

**Recovery of Secondary Metals in 1912.**—In the following table is shown a comparison between the quantities and estimated values of "secondary metals" recovered in this country in the years 1911 and 1912. The above classification includes the copper, lead, zinc, tin and antimony recovered from scrap metal, sweepings, skimmings, drosses and foundry wastes. The figures are found in a report of the United States Geological Survey. While for many purposes these secondary metals cannot take the place of the "primary metals" (those obtained direct from the ores) they form an important part of the total domestic supply as shown in the last column of the table where are given the percentages of the total supply which the secondary metals constituted in 1912:

PRODUCTION OF SECONDARY METALS IN THE UNITED STATES IN 1911 AND 1912

| Metal | 1911 Short Tons | 1911 Value | 1912 Short Tons | 1912 Value | Per Cent |
|---|---|---|---|---|---|
| Secondary copper, including that in alloys other than brass | 50,845 | $12,711,250 | 66,441 | $21,593,325 | 17.5 |
| Remelted brass | 80,370 | 16,814,400 | 101,523 | 27,279,516 | ... |
| Secondary lead | 27,359 | 4,882,860 | 30,266 | 6,045,120 | 13.3 |
| Recovered lead in alloys | 26,895 | | 36,902 | | |
| Secondary spelter | 44,714 | 5,464,800 | 52,251 | 7,750,494 | 24.1 |
| Recovered zinc in alloys other than brass | 3,223 | | 3,912 | | |
| Secondary tin | 7,749 | 12,353,040 | 8,333 | 14,301,368 | 26.6 |
| Recovered tin in alloys | 6,957 | | 7,068 | | |
| Secondary antimony | 10 | 359,040 | 13 | 426,020 | ... |
| Recovered antimony in alloys | 2,359 | | 2,493 | | |
| Total value | | $52,585,390 | | $77,395,843 | |

**Electrical Domestic and Office Supplies.**—The following companies are in the market for electrical supplies and appliances for domestic and office use, such as heaters, cookers, fans, irons, etc.; also for electric-railway supplies, work-shop plant and tools: Pará Electric Railways & Lighting Company, Ltd., Caixa No Correio No. 29, Pará, Brazil; Manáos Tramways & Light Company, Ltd., Caixa No Correio No. 148, Manáos, Brazil; Venezuela Electric Light Company, Ltd., Apartado 175, Caracas, Venezuela; Compañia de Luz y Fuerza Motriz de Cardoba, Calle Rivera Indarte 155, Cardoba, Argentine Republic; Compañia Luz y Fuerza de Parana, Parana, Entre Rios, Argentine Re-

public; Compañia de Electricidad de Merida, S. A., Apartado Postal 193, Merida, Yucatan, Mexico, and the North Melbourne Electric Tramways & Lighting Company, Ltd., of Mount Alexander Road, Ascot Vale, Victoria, Australia. Manufacturers of the above-mentioned apparatus are invited to send catalogs descriptive of the same together with prices and discounts, addressing the manager of the company in each case.

**Middle West Utilities Company Buys Kentucky Property.**—The Kentucky Utilities Company, one of the subsidiaries of the Middle West Utilities Company, has purchased the property of the Cumberland Light & Ice Company, of Pineville, Ky., and is said to be negotiating for other public-utility properties in the State. It is said that a large central generating plant will be built at Winchester.

**Water Supply to Generate Electric Energy.**—It is proposed that the portion of the water supply to Madrid, Spain, which is brought to the city by the Isabel II Canal be utilized for the production of electricity, and it is estimated that 3000 hp could be developed in this way. Until recently there has been fierce competition between the companies supplying electric energy to that city, but a consolidation of interests has caused the rates to advance to a very high figure.

**Electrical Trade in Great Britain During 1912.**—A recent report from the Consular Service states that the electrical trade in Great Britain in 1912, while not particularly large in volume, was very satisfactory in the promise it gave of future expansion of the industry. An increased use of electrical energy in the colliery districts and in the shipbuilding industry together with the growing demand for electric trucks and domestic appliances is taken to indicate a general period of activity and prosperity for the electrical trade in the future.

**Electrical Installations in Big New York Buildings.**—L. K. Comstock & Company, of 30 Church Street, New York, are at present engaged in equipping three large buildings now under construction in New York City. The Western Union Building, at Dey Street and Broadway, will have an isolated plant, as will the factory of the Loose-Wiles Biscuit Company, at Thomson Avenue and Meadow Street, Long Island City, of which mention was made in the *Electrical World* of June 28. Supplementing the previous note, it may be stated that at the last mentioned plant the wiring is to be placed in exposed conduits and arranged for four panels per floor, with a maximum of six outlets per circuit. There will be in all about 4000 single-lamp interior outlets, and another 4000 lamps will supply the exterior illumination. At the new building of the Consolidated Gas Company the wiring is to go into concealed conduits and the switchboard, supplied by the Metropolitan Engineering Company, of New York, is to be built right into the tiled wall of the operating room, ample space being left at the back of the board for inspection and repair work. In the part of this building to be occupied later by the gas company, combination gas and electric fixtures are to be installed, with the gas burners arranged for automatic electric ignition.

**Development of the Lens Sign Business.**—The American Sign Company, of Kalamazoo, Mich., which makes the "American Lens" electric signs, has just moved into its large new factory at the corner of Willard and Cooley Streets in Kalamazoo and extending nearly the entire block from Cooley Street to West Street. This company says that it has the largest establishment exclusively devoted to the manufacture of electric signs in the country. It began its career in 1908 and the business has grown rapidly from the start. Last October the capital stock was increased to $150,000. The new factory provides over 30,000 sq. ft. of floor space and is provided with the latest time-saving and sanitary conveniences. Electric welding is used in making the frames of the signs. One of the features of the building is a display room for the exhibition of a large number of signs of different design. By means of a switchboard any desired sign can be illuminated. The "American Lens" sign is illuminated from the interior by electric incandescent lamps through the Meniscus "searchlight" lenses, for which the company owns the patents. The lenses transmit the light rays in nearly parallel lines, preserving the outline of the letters or design and preventing blurred effects. The company asserts that it saves the purchaser 80 per cent in the cost of electricity for operation as compared with all-lamp signs. A specialty is made of novelty flashing effects. The electrically illuminated great seal of the United States displayed on the Capitol in Washington during the inauguration of President Wilson last March was made by this company. C. M. Davis, the president and general manager of the company, has held that position since the start. H. F. Coon, of Detroit, is vice-president and treasurer, and W. R. Fox is secretary. These gentlemen, together with F. K. Root, the auditor, and N. J. Baumann, assistant superintendent, constitute the board of directors. Edward Baumbeck is superintendent and Benjamin Close is sales manager. The company has a branch factory in New York and contemplates the establishment of branches on the Pacific Coast and in the South.

**Stoker Sales Active Lately.**—From a statement made the latter part of last week by the American Engineering Company, of Philadelphia, Pa., concerning the sales of its Taylor stokers, it would appear that the demand for this apparatus has not suffered any decrease through tariff agitation or any other cause. Among the electrical concerns which have recently purchased these stokers are the General Electric Company, West Lynn, Mass.; Montreal (Canada) Light, Heat & Power Company, United Illuminating Company, of New Haven, Conn.; Detroit Edison Company, of Detroit, Mich.; Philadelphia (Pa.) Electric Company, and Elmira (N. Y.) Water, Light & Railroad Company. A number of railroad and industrial companies have also bought stokers of this type recently, including among others the New York, New Haven & Hartford Railroad Company, Cos Cob, Conn.; Boston (Mass.) Woven Hose & Rubber Company; American Brass Company, Waterbury, Conn.; Bay State Street Railway Company, Chelsea, Mass.; Tremont & Suffolk Mills, Lowell, Mass.; Cochran Chemical Company, Boston, Mass., and the Dominion Iron & Steel Company, Sydney, N. S.

## Industrial Securities

| Security | Capital Stock Listed | DIVIDEND | | QUOTATION | |
|---|---|---|---|---|---|
| | | Per Cent | Period | June 25 | July 1 |
| Allis-Chalmers, t.r., 5th pd | $19,800,000 | ..... | ..... | 7¼ | 6½* |
| Allis-Chal., pf.,t.r.,5th pd. | 16,050,000 | ..... | ..... | 14 | 14 |
| Amalgamated Copper..... | 153,887,900 | 1¼ | Q | 64⅜ | 65⅛ |
| American Tel. & Tel..... | 344,471,400 | 2 | Q | 128½ | 127½ |
| Electric Storage Battery,c. | 16,074,425 | 1 | Q | 45½ | 46½ |
| General Electric..... | 101,363,600 | 2 | Q | 137½ | 135½ |
| Mackay Cos., c..... | 41,380,400 | 1½ | Q | 83 | 89* |
| Mackay Cos., pf..... | 50,000,000 | 1 | Q | 68 | 68* |
| Western Union Tel..... | 99,747,600 | ¾ | Q | 61½ | 62 |
| Westinghouse, E. & M., c. | 34,496,400 | 1 | Q | 60 | 58¾* |
| Westinghouse, E. & M., pf. | 3,998,700 | 1¾ | Q | 109 | 109* |

*Last price quoted.

### NEW YORK METAL MARKET PRICES

| | June 24 | | June 30 | |
|---|---|---|---|---|
| | Bid. | Asked. | Bid. | Asked. |
| Copper: | | | | |
| Standard, spot | 13.62½ | ..... | 13.87½ | ..... |
| | £ s d | | £ s d | |
| London, standard, spot | 63 15 0 | | 64 2 6 | |
| Prime Lake | .... | 14.75 | ..... | 14.87½ |
| Electrolytic | .... | 14.50 | 14.50 | to 14.62½ |
| Casting | .... | 14.37½ | 14.37½ | to 14.50 |
| Copper wire base | 15.75 | to 16.00 | 15.75 | to 16.00 |
| Lead | | 4.35 | | 4.35 |
| Nickel | 40.00 | to 45.00 | 40.00 | to 45.00 |
| Sheet zinc, f. o. b. smelter | | 7.25 | | 7.00 |
| Spelter, spot | 5.15 | to 5.20 | 5.30 | to 5.35 |
| Tin, spot | 43.25 | to 43.75 | 42.50 | to 42.75 |
| Aluminum: | | | | |
| Prompt delivery | 23.50 | to 24.50 | 23.00 | to 24.00 |
| Future | 22.00 | to 23.00 | 22.00 | to 23.00 |

### OLD METALS

| | | |
|---|---|---|
| Heavy copper and wire | 13.50 | 13.50 |
| Brass, heavy | 8.75 | 8.75 |
| Brass, light | 7.75 | 7.75 |
| Lead, heavy | 4.25 | 4.25 |
| Zinc, scrap | 4.12½ | 4.12½ |

### COPPER EXPORTS

Total tons to June 30 ..... 27,539

## Business Notes

**Worcester Electric & Manufacturing Company.**—Mr. Joseph McGrady has been appointed manager of the Boston office of the Worcester Electric & Manufacturing Company, the home office of which is at Worcester, Mass.

**Lockwood, Greene & Company,** architects and engineers for industrial plants, 60 Federal Street, Boston, have removed their New York offices from 320 Fifth Avenue to the Architects' Building, 101 Park Avenue. The New York representatives of this concern are Frank A. Wing and John M. Toucey.

**Franklin Electric Manufacturing Company.**—Mr. Thomas G. Truitt is no longer associated with the Imperial Electric Company, Philadelphia, Pa., but will continue to represent the Franklin Electric Manufacturing Company, manufacturer of incandescent lamps, Hartford, Conn., in eastern Pennsylvania, Delaware, Maryland and southern New Jersey, with temporary offices at 1704 Arch Street, Philadelphia, Pa.

**Mr. R. W. Weekes,** of Maxwell House, Arundel Street, Strand, London, has just taken into partnership Mr. Alfred O. Kolkhorst, M. I. E. E., and the future name of the firm will be Weekes & Kolkhorst. Mr. Kolkhorst has resided for many years in Chile, acting as general manager of the Chilean Electric Tramways & Light Company, of Santiago, and of the Valparaiso Electric Tramways & Light Company. He also acted as manager of the Over Sea Electric Power Company, which furnished electricity from its hydroelectric station to the city of Santiago, Chile.

## New Industrial Companies

**The American Engine & Electric Company,** of Buffalo, N. Y., was recently incorporated under the laws of Delaware, with a capital of $800,000. W. H. Pyle, Wilmington, Del., chief incorporator.

**The Electric Commercial Company**, Evanston, Ill., has been incorporated with a capital stock of $6,000 to deal in electrical apparatus. The incorporators are Morris K. Levinson, E. Roesing and A. S. Dwyer.

**The Phelps Manufacturing Company,** capitalized at $10,000, was incorporated at Providence, R. I., to manufacture and sell electrical and mechanical apparatus and chemical preparations. Incorporators: E. I. Whitaker, William A. Peck and J. C. Kendrick.

**The American-Oriental Electric Appliance Company** has been granted a charter for a term of fifty years to transact a general business in electrical appliances in Honolulu, Hawaii. Capital stock, $10,000, with permission to increase capitalization to $1,000,000. The officers of the company are: H. H. Taylor, president; F. E. Thompson, vice-president; W. T. Yin, treasurer, and C. Q. Yee Hop, director.

## Trade Publications

**Electric Supplies.**—The Union Electric Company, Pittsburgh Terminal Warehouse, Pittsburgh, Pa., has recently issued a new fifty-six page discount sheet, applying to its No. 6 electrical supply catalog.

**Ornamental Posts.**—An article on ornamental street-lighting systems has been published in the form of a folder by the Electric Railway Equipment Company, Cincinnati. Various types of ornamental posts are illustrated.

**Battery Switches.**—In an eight-page leaflet printed by the Trumbull Electric Manufacturing Company, Plainville, Conn., a complete line of battery switches made by the company is shown. Brief reference is made to each type and a price list given.

**Irrigation Pumps.**—The increasing interest in the subject of irrigation makes timely and interesting the well-illustrated thirty-two-page pamphlet issued by the Goulds Manufacturing Company, Seneca Falls, N. Y., on its irrigation pumps. Illustrations are given of a number of successful installations, showing the wide variety of conditions met.

**Polerector.**—A leaflet has been issued by W. N. Matthews & Brother, St. Louis, Mo., which tells about its "polerector." By the use of this device it is claimed that two linemen and a boy to handle the team can erect in a day an average of forty to fifty poles of any length up to 50 ft.

**Appraisals.**—H. M. Byllesby & Company, Insurance Exchange Building, Chicago, through the department of examinations and reports, have issued a folder—"The Valuation Problem"—known as Department Bulletin No. 5. In this circular are set forth the facilities possessed by the Byllesby company for making valuations of public utilities.

**Fixtures.**—In a publication of the Tungstolier Works of the General Electric Company, Conneaut, Ohio, are described briefly several complete sets of fixture designs, and much information is given on the semi-indirect unit. The number dated May-June, 1913, contains twenty-four pages devoted to brief descriptive items and illustrated articles on lighting units, fixture making and holders, and hints to dealers and solicitors.

**Connectors.**—A sixty-two-page catalog, published by Dossert & Company, 242 West Forty-first Street, New York, refers to Dossert solderless connectors for solid and stranded wires and gives price lists, code words, dimensions and useful information. The different types of connectors, together with the use for which each is intended, are fully described, while the dimensions of all standard connectors are given. The catalog is well illustrated.

**Fuel Economizers.**—Two articles from engineering publications have been reprinted under one cover by the Green Fuel Economizer Company, Matteawan, N. Y., known as Bulletin No. 148. "Heating and Ventilating a Large Factory," taken from the *Iron Age*, and "Heat Transmission Through Building Walls of Corrugated Iron," reprinted from the *Engineering News*, are the articles that compose the pamphlet, which is fully illustrated with photographs and drawings.

**Control Apparatus.**—The automatic control of machine tools is the subject of a paper by Mr. H. F. Stratton, reprinted from the *American Machinist*, published by the Electric Controller & Manufacturing Company, Cleveland, Ohio, under the title "More Chips." The pamphlet describes a system for controlling motor-driven machinery, which in many cases increases the output by from 10 to 40 per cent; through the use of this apparatus more chips are made, and hence the title of the pamphlet.

**The Valuation Problem.**—The department of examinations and reports of H. M. Byllesby & Company, of Chicago, has issued its Bulletin No. 5. This bulletin relates to "The Valuation Problem." It is stated that the valuation of public-service utilities is developing rapidly into a separate and difficult profession, the mission of which is to lay the foundation for the settlement of far-reaching industrial disputes. H. M. Byllesby & Company offer their services in making valuations for railroads, public-utility companies and manufacturing enterprises.

**Stokers.**—Inclosed within an artistic cover, under the simple title "Morning," is a well-expressed reflection on the beginning of the worker's day, which leads to the statement that the stoker makes possible the laborless plant. In the morning only one person is necessary to keep the plant in operation, whereas in mills and factories thousands flock in the morning. With the use of the stoker the human element is practically eliminated. The brochure is copyrighted by the American Engineering Company, Philadelphia, maker of the Taylor stoker.

**Steam Turbines.**—The De Laval velocity-staged turbine is the subject of a well-printed 108-page pamphlet just issued by the De Laval Steam Turbine Company, Trenton, N. J. The book sets forth the history, theory and construction of this turbine. It contains a number of suggestions with diagrams for efficient utilization of the steam consumed for driving auxiliaries in large generating stations and a more efficient cycle for exhaust-steam heating and drying plants. Photographs, diagrams showing constructive features, and curves all add to the general interest of the descriptive matter.

# Personal Mention

**Mr. Charles Steele** has been appointed superintendent of the municipal electric-lighting plant at Kingfisher, Okla.

**Dr. Albert C. Crehore** returned to New York on the *Minnetonka* June 30 from a two months' trip to Europe.

**Mr. Walter Eyke,** of Muskegon, Mich., has been appointed general superintendent of the Muskegon Light & Traction Company.

**Mr. F. A. Nims,** of Muskegon, Mich., has been appointed successor to Mr. John T. Young as president of the Muskegon Light & Traction Company.

**Mr. Cyrus Leland, Jr.,** has succeeded Mr. W. C. Stewart as superintendent of the electrical department of the Atchison Railway, Light & Power Company, Atchison, Kan.

**Mr. J. C. Reighard,** retiring manager of the Penn Central Light & Power Company at Lewistown, Pa., was the guest of honor at a banquet tendered to him by the local Elks Club on June 20.

**Mr. Harry G. Hake,** formerly instructor in electrical engineering at the University of Illinois, has been appointed assistant professor of electrical engineering at Washington University, St. Louis, Mo.

**Mr. I. O. Ingalls,** formerly engineer in the arc lamp department of the General Electric Company, at Lynn, Mass., has become associated with the city lighting department at Edmonton, Alberta, Canada.

**Mr. Martin S. Decker** has been designated as chairman of the Public Service Commission of the Second District of New York by Governor Suizer as successor to Mr. Frank W. Stevens, who resigned recently.

**Mr. Raymond L. Patterson** has resigned his position as engineer in charge of the manufacture of ductile tungsten and molybdenum wire for the Westinghouse Lamp Company, Bloomfield, N. J., to become associated with the Hooker Electrochemical Company at Niagara Falls, N. Y.

**Mr. Val. A. Fynn,** consulting engineer to the Wagner Electric Manufacturing Company, St. Louis, Mo., left New York June 30 on the *Mauretania* for a three months' trip to Europe. After visiting his home in London Mr. Fynn will spend considerable time climbing mountains in Switzerland and Italy.

**Dr. William Marconi,** who spent the month of June in this country chiefly in looking after his interests in the patent suit described in our issue dated June 28, 1913, left New York for London July 2 on the *Mauretania.* He will return to New York in October for the opening of the radio-telegraph station at Belmar, N. J.

**Mr. A. S. Herbert** has resigned his position as general manager of the Siemens Company of Canada, Ltd., and has been appointed general manager of the branch offices of the Siemens company in Australia. His successor in Canada is Mr. C. A. Ablett, who has been closely associated with the electrification of rolling mills in Europe.

**Hon. George W. Anderson,** nominated to the Massachusetts Public Service Commission, was born in Acworth, N. H., in 1861. He was educated at Cushing Academy, Ashburnham, Mass., Williams College and Boston University Law School, and has practised law in Boston since 1890. In 1912 he was the Democratic candidate for attorney-general.

**Mr. V. Ford Greaves,** who was for a number of years connected with the research department of the Jefferson Physical Laboratory, Harvard University, and recently entered the government service as radio inspector, has been made chief of the radio service of the Bureau of Navigation, Department of Commerce, which has charge of the enforcement of the new radio laws.

**Mr. B. S. Josselyn,** who retired as president of the Portland Railway, Light & Power Company, Portland, Ore., on July 1, 1913, was the honor guest at a banquet at the Arlington Club in Portland given by the other officers of the company and a number of his business associates outside of the company. Eleven pieces of silver, comprising a Paul Revere set, were presented to Mr. Josselyn by the officers and employees of the company, Mr. F. I. Fuller making the presentation speech.

**Hon. George P. Lawrence,** nominated to the Massachusetts Public Service Commission by Governor Foss, is a native of North Adams, Mass. He graduated from Amherst College in 1880 and studied law at Columbia University. He was admitted to the bar in 1883, and from 1885 to 1894 was judge of the district court of Northern Berkshire. He has served three terms in the Massachusetts Senate, being president of that body in 1896-7, and has served continuously as a member of Congress since 1899, having been elected in 1897 to fill an unexpired term.

**Mr. William Stanley,** who was the recipient of the Edison medal on June 26 at the convention of the American Institute of Electrical Engineers, has long been famous in the history of electrical development in this country as one of the leaders in high-tension work. He was born in Brooklyn, N. Y., Nov. 22, 1858, and was educated at the Williston Seminary at East Hampton, Mass., and at Yale; but electrically he is a self-educated man. While engaged in the nickel-plating business in New York in 1879 he became acquainted with Mr. Hiram Maxim, who was then one of the foremost electrical engineers in the country. Mr. Stanley became principal assistant to Mr. Maxim, and when Mr. Maxim left the United States for the Paris Exposition in 1881 Mr. Stanley became assistant to Mr. Edward Weston. In 1882 he joined the staff of the Swan Electric Light Company, where he invented a method of exhausting incandescent-lamp bulbs, and during 1883 and 1884 he conducted a private laboratory at Englewood, N. J., devoting himself to storage-battery work chiefly. His acquaintance with Mr. George Westinghouse began in 1884, and a contract was made by which Mr. Stanley was to devote his time to developments in which he was interested and Mr. Westinghouse was to promote them as a business enterprise. During tnat year Mr. Stanley installed and equipped a lamp factory at Swissvale, Pa., designed some direct-current machines adapted to operate incandescent lamps, and was generally occupied with a system for this line of work. In the spring of 1885 he was taken sick and removed to Great Barrington, Mass., and while recovering there concentrated his attention on the problem of alternating-current distribution and submitted his plans to Mr. Westinghouse and a number of friends. Failing to secure the indorsement he had looked for, he rented a mill at Great Barrington and ultimately developed a 500-volt alternating-current system the energy from which was distributed in Great Barrington through the medium of transformers connected in multiple. The Westinghouse companies, realizing the value of the system, immediately took steps to develop the manufacturing details, and the great achievements that soon followed at Niagara Falls were largely contributed to by the Stanley inventions. In the winter of 1890-1891 Mr. Stanley organized the Stanley Electric Manufacturing Company at Pittsfield, Mass., his associates in the enterprise being Messrs. John F. Kelly and C. C. Chesney, and the famous S. K. C. apparatus came as the result of this organization. Later the Stanley Instrument Company was organized for the manufacture of a new form of wattmeter, and for several years Mr. Stanley devoted his time to this enterprise. When the Stanley companies were bought by the General Electric Company Mr. Stanley engaged in consulting work for that company, his time being devoted principally to the development of an electric stove built to conserve heat.

# Obituary

**Ernst Ruhmer,** who died lately at the early age of thirty-five, was one of the best-known and most fertile contemporary German inventors. Among his inventions were a selenium photometer, a device for measuring and recording the intensity of daylight, an arc-lamp interrupter, a television apparatus, a system of light telephony using selenium cells and controlled projector beams, and apparatus for photographically recording and mechanically reproducing sound waves. Mr. Ruhmer was the son of an engineer and was educated at Charlottenburg, Berlin and Giessen. He later established an electro-physical laboratory near Berlin and wrote several books on the subjects of wireless telephony and telegraphy, selenium-cell operation, etc.

# Construction

## New England

NASHUA, N. H.—Work has begun on the white way system for Main Street as far as Abbott Square. Geo. L. Sadler, superintendent of the Nashua Lt., Ht. & Pwr. Co., has the work in charge.

RAYMOND, N. H.—Sixteen miles of 11,000-volt, three-phase transmission line will be built by the Raymond Electric Co. during the next four months. The company will also purchase one 300-gal. triplex pump directly connected to a three-phase motor with remote control. C. F. Gardner, manager.

SOUTH HADLEY FALLS, MASS.—The town has appropriated $250 to investigate the advisability of establishing a municipal lighting plant and appointed a commission to investigate and report at a future date. Mortimer Madsen, town clerk.

TAUNTON, MASS.—M. C. Golden, manager of the municipal plant here, favors the installation of a new turbo-generator, at a cost of $50,000, to meet the requirements of increasing business and as an emergency unit. The Council has the matter under consideration.

WORCESTER, MASS.—Bids will be received until July 14 by the Board of Trustees, Worcester State Asylum, at the office of Fuller & Delano Co., architects, 44 Front Street, Worcester, for the general construction and electric wiring of a number of buildings.

## Middle Atlantic

CROTON FALLS, N. Y.—The Croton Falls Electric Light Plant will shortly purchase a quantity of No. 4 and 6 weather-proof wire. Geo. Juengst, Jr., manager.

EAST WORCESTER, N. Y.—The Great Bear Lt. & Pwr. Co., which recently acquired the lighting plant at Schenevus, is planning to purchase one 100-kw single-phase generator, two switchboard panels, two series tub transformers, 500 5-ft. four-pin cross-arms, 25 miles of No. 4 copper wire and a number of meters and 40-watt tungsten lamps. The proposed extensions will be in charge of George H. Blake, and the work will be done by the company. William F. Shupe, treasurer and manager.

HAMILTON, N. Y.—One 100-kw engine-type generator with exciter will be purchased during the next two months by the municipal light and water plant. E. L. Kingsbury, superintendent.

HILTON, N. Y.—The Hilton El. Lt., Pwr. & Ht. Co. (formerly the Hilton, Tel. Co.) expects to purchase within the next three months one 100-hp marine boiler, a new generator and a feed-water heater. J. E. Cooper, president and manager.

LE ROY, N. Y.—The LeRoy Hydraulic Elec. Gas Co. is now changing from 133 cycles to 60 cycles; it also plans to change the street-lighting system in the near future, for which the necessary equipment will be required. J. C. Ross, secretary.

PERRY, N. Y.—A new street light equipment will be installed here, and the Perry El. Lt. Co. will purchase the material for same during the next three months. C. W. Torrey, superintendent; E. L. Phillips, engineer.

CHAMBERSBURG, PA.—The time for receiving bids for the equipment of the municipal lighting plant has been extended to July 7. Bids will be opened at 1 p. m. Specifications may be had by addressing the town clerk.

PUNXSUTAWNEY, PA.—Supplies and material for a transmission line to furnish energy for mine operations will be purchased within the next three months by the Jefferson Lt., Ht. & Pwr. Co. W. M. Krise, manager.

WILKES-BARRE, PA.—Joseph A. Murray, 25 Madison Street, Wilkes-Barre, Pa., is seeking quotations for one three-wire 25-kw, 125-250-volt direct-current generator, belted, 200-amp-hr. storage battery, switchboards, meters, lightning arresters, wire, cross-arms, pins and glass insulators.

LAKEWOOD, N. J.—Eleven miles of poles and line material are to be purchased at once by the Lakewood Wtr., Lt. & Pwr. Co. H. M. Whitehead, superintendent.

LONG BRANCH, N. J.—Extensions and improvements made by the Consolidated Gas Co. of New Jersey called for a purchase of a 1000-kw Westinghouse-Parsons turbine with Alberger surface condenser; also one 500-hp Stirling water-tube boiler with Murphy stoker and Foster superheater, to accommodate which the station was enlarged. A reinforced concrete stack 175 ft. x 9 ft. and steel smoke flue for three boilers, replacing an old steel stack and flue, have recently been added.

EMMITTSBURG, MD.—The Emmittsburg El. Co., recently incorporated, will sell electricity for lighting and motor service, which is bought from the Hagerstown & Frederick Ry. Co., at Thurmont, Pa. At present there is only a substation at Emmittsburg, consisting of a number of transformers. B. M. Kershner is secretary.

ELKINS, W. VA.—The Elkins Pwr. Co. expects to purchase within the next three months one 50-lamp outfit for series arc street lighting. C. C. Bosworth, superintendent.

KEYSER, W. VA.—Within the next six months the Keyser El. Lt. Co. expects to erect a 300-hp engine, a 300-kw generator, a 150-hp boiler and switchboard complete. N. J. Crooks is secretary and treasurer.

KEYSTONE, W. VA.—The Keystone Lt. & Pwr. Co. has been taken over by the Appalachian Pwr. Co., Bluefield, W. Va.

SISTERVILLE, W. VA.—Bids will be received until Aug. 5 for the construction complete, including electric conduits and wiring, interior lighting fixtures and approaches, of the United States post office at Sisterville, W. Va. O. Wenderoth, supervising architect, Washington, D. C.

WILLIAMSON, W. VA.—The Williamson Lt. & Ice Co. expects to increase the rated output of its ice plant from 10 to 30 tons. O. B. Welch is superintendent.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, until July 28, for a conduit and wiring system in the United States Marine Hospital, Chicago, in accordance with drawings and specifications, copies of which may be obtained at Washington.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the supervising architect until Aug. 4 for the construction complete, including electric conduits and wiring, interior lighting fixtures and approaches, of the U. S. post office at Xenia, Ohio. Drawings and specifications may be obtained from the custodian of site at Xenia, or from O. Wenderoth, supervising architect, Washington, D. C.

## North Central

FLUSHING, MICH.—The Hart Milling & Pwr. Co. is to take over the city lighting plant and will be in the market during the next two months for 24 hangers and other equipment for installing an incandescent lighting system. R. O. Hart is in charge.

GREENFIELD, OHIO.—The water and light department anticipates purchasing a three-phase, 60-cycle, 110-220-volt motor-driven outfit for pumping water. The water and light plant combined has an abundance of power, and will have a pumping capacity of 1,000,000 gal. a day. D. R. Cowman, manager.

GREEN SPRING, OHIO.—The Green Spring El. Lt. & Pr. Co. expects to install within the next two months an oil engine and a 10-kw, three-wire, 110-220-volt direct-current generator, which have already been purchased. Within the next three months, the purchases contemplated include 50 2-wire, 5-amp direct-current meters. D. M. Scott, manager.

LOUISVILLE, KY.—The Louisville Gas & Elect. Co. will have a substantial and well-equipped garage and stables for its transportation department, where both motor-driven and horse-drawn vehicles will be cared for. The building will be heated with natural gas and lighted with electricity. A well-equipped machine and blacksmith shop will be provided to take care of necessary repairs.

PERRYVILLE, KY.—The Perryville Ice & Ltg. Co., recently established, is planning to increase its capacity to give 24-hour service. W. J. DeBaun, general manager.

WALKERTON, IND.—Construction work contemplated during the next few months by the municipal electric-light department includes the erection of a 90-kw, three-phase outdoor substation. Energy will be purchased from the Plymouth (Ind.) El. Lt. & Pwr. Co. The necessary meters and switches for the above substation will also be purchased shortly. The street lighting system will be changed to three-phase. A. L. Freyer is superintendent of the electric-light department.

BROWNING, ILL.—The village board has granted a franchise to the Central Illinois Public Service Co., of Mattoon, Ill., to sell light and power in Browning. A transmission line will be built from Beardstown.

BUSHNELL, ILL.—The Central Ill. Pub. Serv. Co. expects to erect within the next ten days a 300-kw transformer substation, to be used for transforming energy from 33,000 to 2,300 volts, and the town is to have 24-hour service. J. M. Freeman, Jr., local superintendent.

CHICAGO, ILL.—The municipal electric lighting plant of Chicago expects to make a number of extensions and improvements in the future. Among other equipment to be purchased are the following materials: Four or six 3000-kva substations to deliver energy to 15,000 flame arc lamps, with suitable switching and protective equipment for the above; 80,000 30-ft. tubular steel poles, wire, cable and ducts; 15,000 flame arc lamps and 6000 80-watt, 100-cp series tungsten lamps. Ray Palmer, city electrician.

FREEPORT, ILL.—The contract for lighting Taylor's Park, mentioned May 24, has been awarded to Albert Barnes. The contract calls for seven ornamental lamp-posts, some with two lamps and others with one. The electric wires will be laid underground.

HOMER, ILL.—U. S. Thompson, owner of the electric lighting plant, intends to erect shortly a concrete smokestack for a new power house. A new boiler feed pump will also be bought.

MANITO, ILL.—The municipal electric light plant is planning to construct a new concrete building within the next six months, along the C., P. & St. L. R. R. siding, 30 ft. x 140 ft., large enough to install water works in the future. Within the year there will be purchased one 80-100-hp boiler and one 50-75-hp engine, motor-driven.

MATTOON, ILL.—The municipal electric lighting plant within the next three months expects to erect a 5-mile 2300-volt transmission line. Equipment to be purchased includes among other things one 350-hp water-tube boiler, one 2300-volt 75-kw alternating-current generator, one electrically-driven pump, alternating-current voltmeters and ammeters, poles, insulators, cross-arms and transformers. W. S. Bury, city electrician.

METROPOLIS, ILL.—The municipal electric lighting plant has recently purchased a new Ideal engine and a 100-kw three-phase generator, 60 cycles, 2300 volts. Tub transformers and street lighting fixtures will be purchased shortly. P. M. Richards, superintendent.

MOLINE, ILL.—Bids will be asked for at once for the installation of a "white way" along Fifteenth Street. Modern five-lamp ornamental posts are to be erected from Fourth Avenue to Eighth Avenue, and may be extended north of the railroad tracks. There will be 16 posts to a block. The property owners are to pay for the posts and also for the energy consumed by the lamps.

MORTON, ILL.—The Bloomington & Normal Ry. & Lt. Co., which operates the Morton Lt., Ht. & Pwr. Co., is building a substation in Morton to handle the service of the town from Bloomington. For converting from 25 cycles to 60 cycles, frequency changes are being installed and considerable work is being done rebuilding the outdoor plant. M. G. Linn, general superintendent, Bloomington, Ill.

MURPHYSBORO, ILL.—The street-lighting system is being changed from arc to tungsten by the Murphysboro Wtr. Wks. & El. Lt. Co., W. O. Settle, superintendent.

NAUVOO, ILL.—The Nauvoo El. Lt. & Pwr. Co. expects to erect within the next few months a 6-mile transmission line. There will be purchased a new generator, transformers, poles and incandescent lamps. The company intends to change from 220-volt direct current to 110-volt alternating current. Jos. Nelson, manager.

PALESTINE, ILL.—The municipal lighting plant expects to build an extension to its present plant. S. H. Markee, city clerk.

PEORIA, ILL.—The rebuilding of the power plant of the Peoria Gas & El. Co. is expected to be completed within the next few months. There will be installed a 5000-kw turbo-generator condensing equipment, a 10,000-sq. ft. Sturtevant economizer and fan and switchboards. A transmission line to Farmington and Elmwood, Ill., and several substations will be built within the next few months, and there will shortly be purchased incandescent street lighting equipments for small towns.

SILVIS, ILL.—The railroad plant at this place is having an entirely new lighting system installed. A. Wanamaker is the electrical engineer in charge of the installation.

SPRINGFIELD, ILL.—The City Council opened bids for construction and material for a transmission line from the municipal electric light plant to the water-works station on the Sangamon River, as follows: The A. H. Barth El. Co. bid $11,072 for red-cedar poles and No. 2 wire; for white-cedar poles and No. 0 wire, $12,653; for white-cedar poles and No. 2 wire, $11,902. The Champaign Gas & El. Co. bid $9,960 for red-cedar poles and No. 2 wire; for white-cedar poles and No. 0 wire, $11,998; for white-cedar poles and No. 2 wire, $10,369. The Champaign company also submitted a bid for work on red-cedar poles and No. 0 wire, the figure being $11,765.

DOWAGIAC, WIS.—Two 6.6-amp, 60-cycle, 1100-volt primary, 8-kw and 12-kw constant current regulators will be purchased within the next three months for the municipal electric lighting plant. William E. Reynolds, superintendent.

GALESVILLE, WIS.—Within the next two months the Davis Mill Co. is contemplating building an addition to its hydroelectric plant. Later on it is the company's intention to change from direct to alternating current, and the necessary equipment for this change will be purchased. B. W. Davis, manager.

LA FARGE, WIS.—The La Farge Milling Co., which owns the water-power rights, is talking of building a new dam and constructing a power station.

LAKE MILLS, WIS.—The municipal electric light and water plant within the next two months expects to purchase a one-panel 13,000-volt switchboard, with switches and protective devices, and early in the fall a series street-lighting system will be installed. B. C. Engsberg, superintendent.

PIPESTONE, MINN.—The Pipestone El. Lt., Ht. & Pwr. Co. has extended its system a distance of 2 miles to Indian School and installed a new street-lighting system in Pipestone, besides adding five additional miles of line to the system. The generators, boilers and other equipment necessary for these improvemeints have been bought. Transformers will shortly be purchased for changing the system from direct current to alternating current; total about 100 kw. A 15-kw series lighting transformer and panel have already been purchased. J. W. Campbell, Jr., manager.

VIRGINA, MINN.—On Aug. 1 the Virginia El.. Pwr & Wtr. Co. expects to deliver possession of its plant to the city of Virginia for a consideration of approximately $600,000. The plant will be run for the city by a commission of three local citizens. O. H. Griggs, president.

WINDOM, MINN.—At the special election recently held to vote on the proposition to issue bonds to the extent of $15,000 for improvements and extensions to the municipal lighting plant, mentioned June 21, the measure was defeated. G. Neufeld, city clerk.

WORTHINGTON, MINN.—Some line extensions are contemplated by the municipal light and water plant. W. H. Buchan, superintendent.

ALTON, IA.—Electroliers for Main Street are being discussed.

HAMPTON, IA.—The Hampton El. Lt. & Pwr. Co. expects to purchase at once two alternating-current, 60-cycle, three-phase generators, one 75-hp, 2400-volt three-phase induction motor, one engine, an entirely new complete switchboard and a few transformers. M. A. Harrison, manager.

HARTLEY, IA.—Early in July a 50-hp oil engine will be purchased by the municipal electric-light plant, together with a 250-volt, three-wire generator. R. E. Lampman, superintendent.

LINN CREEK, MO.—The Naingua Heights Development Co. will build a station adjoining this place, to furnish lighting and motor service for the grounds of its pleasure park, club houses and bungalows. The equipment has not yet been determined upon. R. G. Scott & Sons, Linn Creek, Mo., are the engineers in charge of the work.

MAYVILLE, N. D.—Bids will be received until July 15 (readvertisement) by C. A. Vangen, city auditor, for furnishing material and equipping a complete electric light plant. Clausen Engr. Co., engineers, Commercial Building, St. Paul, Minn.

CHANCELLOR, S. D.—An electric-light system is to be installed here.

HARTINGTON, NEB.—It is reported that K. S. Gaynor, Sioux City, Neb., has purchased the electric light plant at Hartington and will have it thoroughly overhauled before placing it in operation.

CONCORDIA, KAN.—The Concordia El. Lt. Co. will build a substation at Burr Oak, in addition to making the extensions mentioned June 7. L. K. Green, vice-president.

KANSAS CITY, KAN.—The town recently voted $200,000 for the purpose of extending the electric-light plant.

## Southern States

MOUNT OLIVE, N. C.—S. L. Oliver, manager of the municipal electric lighting plant, announces the closing of a contract for wiring the Presbyterian Church at Mount Olive, which will be the first indirect system of lighting in the town. The National X-Ray Reflector Co., Chicago, planned the installation. Wiring supplies of all kinds will shortly be purchased.

UNION, S. C.—Within the next few months the commissioners of public works will spend about $5,000 in improving the municipal lighting plant. The expenditure will practically double its equipment. On Main Street an entirely new line of poles will be erected.

AMERICUS, GA.—There will be a consolidation of the Americus Gas & El. Co. and the Americus Pwr. Co. during the next sixty days, under the name of Americus Pwr. Co. W. M. Case is the general manager.

MARSHALLVILLE, GA.—The bond issue proposed for an electric light plant has been defeated.

PUNTA GORDA, FLA.—R. K. Seward, clerk, reports that the municipal electric light and water plant has contracted with the Punta Gorda Ice Co. (a Southern Utilities Co. property) for energy to operate the city plant for 10 years. The ice company will install a 100-kw alternator. A plan is on foot to bond the city for $60,000 for paving and sewage. The city will require considerable wire and about 500 additional 60-watt and 100-watt, 110-volt lamps this fall.

ST. ANDREWS, FLA.—The St. Andrews Ice & Pwr. Co., which has recently been granted a franchise to operate an electric light plant here, will be in the market for two 75-kw alternating-current generators, engines, switchboards, lightning arresters, wiring material and other supplies. One 80-hp and one 120-hp boiler have already been installed. For complete list of materials address J. H. Drummond, St. Andrews, Fla.

ST. PETERSBURG, FLA.—A power house will be erected during the next six months by the St. Petersburg Investment Co. Contracts have been placed for generators, boilers and engines. Within the next two months the company plans to purchase wire and poles for a two-mile transmission line. H. C. Case, general superintendent.

WATERTOWN, FLA.—The East Coast Lumber Co. plans to install an electric light plant to operate its mill and to furnish light and power to the town.

CHATTANOOGA, TENN.—The Chattanooga & Tennessee Pwr. Co. will erect an auxiliary plant to develop 25,000 hp. W. E. Boileau, general manager, Chattanooga.

HUNTINGDON, TENN.—The municipal water and electric lighting plant expects within the next three months to purchase 5 miles of No. 8-10-6 copper wire, poles, cross-arms and insulators, 40 tungsten street hoods complete, and a 6-amp, 1100-volt, constant-current transformer, with switchboard. J. M. Dill, manager.

BREWTON, ALA.—The Downing Industrial School is considering the installation of a private lighting plant, at an approximate cost of $55,000. W. W. Downing is chairman of the building committee.

HARRISON, ARK.—Improvements and additions will be made to the plant of the Harrison El. & Ice Co. Mr. R. M. Fellows, treasurer and

manager, has sold the water-works system and franchises to J. O. Nelson and C. L. Henderson, but retains his interest in the lighting and ice plants. Messrs. Nelson and Henderson plan to install modern pumping machinery and to build a 100,000-gal. concrete reservoir.

JUNCTION CITY, ARK.—The Citizens' Ice & Public Utility Co., organized to merge the Citizens' Ice & Bottling Co., Junction City Lt. & Wtr. Co. and Local Tel. Co., will operate the electric lighting plant under the new name. R. G. Brown is president and general manager.

CHICKASHA, OKLA.—Bids will be received until Aug. 4 for the construction, complete, of the United States post office and court house at Chickasha, Okla. O. Wenderoth, supervising architect, Washington, D. C.

ARANSAS PASS, TEX.—C. J. Stanzel, Aransas Mach. & Boiler Wks., has been granted a franchise by the City Council for the erection of an electric generating station.

DEL RIO, TEX.—Bids will be received July 22 by O. Wenderoth, supervising architect, Washington, D. C., for installing complete an electric passenger elevator in the United States post office at Del Rio.

## Pacific States

BELLINGHAM, WASH.—Patents to six mineral claims on the Nooksack River, held by the Whatcom Co. Ry. & Lt. Co. (a Stone & Webster corporation), were declared void recently by Judge Cushman in the United States District Court, and the land, which includes 300 ft. of waterfall, reverts to the federal government. The water power is estimated to be worth several million dollars, and a $500,000 power house built by the Whatcom company near the property will be practically valueless. The company furnished electrical energy to Bellingham and vicinity. It was contended by the government that the sole object of the company in seeking the sites was to take the power opportunities and that no mineral deposits, veins or lodes ever existed on them.

EVERETT, WASH.—The County Commissioners were recently petitioned by the Pacific Northwest Traction Co. for permission to construct, operate and maintain electric transmission lines in Township 28. The Pacific Co. is closely identified with the Puget Sound Traction, Lt. & Pwr. Co., one of the Stone & Webster properties.

GOLDENDALE, WASH.—The Oregon-Washington Tel. Co., recently organized at Hood River, Ore., has taken over the leases, franchises and contracts of the Home Tel. Co., of Hood River, White Salmon Valley Tel. Co., of White Salmon, Wash., and the Goldendale (Wash.) Tel. & Tel. Co., and will operate them under the name of the Oregon-Washington Tel. Co. It is reported that reconstruction work has been ordered to begin at once.

MONTESANO, WASH.—An application has been made by F. Norton Babo and F. L. Harung for a franchise to operate an electric light and water system. If granted, work will be started shortly. F. L. Harung, who, with Mr. Babo, recently organized a company for this purpose, is prominently identified with the Hoquiam Sash & Door Co.

OLYMPIA, WASH.—The Olympia Water Works has received a franchise for the city for the installation of a 1000-kw plant and will furnish electricity as well as steam heat in the business district. C. A. Harmony, manager.

SEATTLE, WASH.—The Puget Sound Traction, Lt. & Pwr. Co. expects within the next six months to install one 1000-kw, 13,200-to-600 volt direct-current motor-generator set; three 50,000-volt oil switches in its Jefferson Street substation; two 200-amp automatic feeder regulator panels for lighting circuits as well as an up-to-date protective relay system on its transmission lines. The company will also erect within the next half-year a 52-mile, 60,000-volt transmission line and will install three 60,000-volt oil switches, three 13,000-volt oil switches, two 60,000 and 13,000-volt lightning arresters and one panel switchboard with meters for two 13,000-volt feeders. It will also erect 9 miles of 13,000-volt transmission lines and distribution lines. W. J. Grambs, superintendent light and power.

SPRINGDALE, WASH.—The Camas Valley Tel. Co., operating in this city and vicinity, plans new construction work as well as reconstruction of existing equipment.

BAY CITY, ORE.—The City Council recently granted an electric service franchise to the Bay City Land Co., which has taken over the present lighting plant, which will be reconstructed at once. The city reserves the right to purchase the plant in 1920, or at the end of any three-year period thereafter.

PORTLAND, ORE.—The Northwestern El. Co. has completed plans for a substation and transformer house, to be erected in the Albina district, Portland. Work will begin immediately.

PORTLAND, ORE.—Bids are being received for the installation of a boulevard lighting system on the East Twelfth Street bridge across Sullivan's Gulch, Portland. Plans are in the office of A. L. Barbur, city auditor.

BURBANK, CAL.—The city of Burbank and the Burbank El. Lt. & Pwr. Co. have joined in an application to the State Railroad Commission asking that the city of Burbank be given permission to purchase the plant of the Burbank El. Lt. & Pwr. Co.

CHINO, CAL.—The Home Tel. Co., of Chino, has applied to the State Railroad Commission for permission to construct and operate a telephone and telegraph system in the city of South Pasadena, Cal.

LOS ANGELES, CAL.—The City Council of Los Angeles has under its consideration an ordinance providing for the extension of the ornamental lighting system on Hill Street, from Pico Street to Washington Street. A similar ordinance is being considered for Ninth Street, between Main and San Pedro Streets.

PALO ALTO, CAL.—The City Council has authorized the purchase of an oil engine and generator for the municipal lighting plant, at a cost of $27,000, bonds for which were recently voted, amounting to $19,000.

PERRIS, CAL.—Bids are being received by the board of city trustees for furnishing and installing an electrically driven pumping equipment, in accordance with specifications in the hands of the city clerk.

RIONIDO, CAL.—The Mount Jackson Wtr. & Pwr. Co. has applied to the State Railroad Commission for permission to issue bonds to the amount of $11,000 for the purpose of paying off existing indebtedness and of making extensive improvements in its system.

TURLOCK, CAL.—The Yosemite Pwr. Co. has just completed a 10-mile power line from Turlock to Denair, and will soon begin the installation of a distribution system in Denair.

VISALIA, CAL.—It is rumored that the Mount Whitney Pwr. & El. Co. is preparing plans for the Tuolumne Lt. & Pwr. Co. project. It is planned to start work this summer on the immense power project to generate power from the north, middle and south forks of the Tuolumne River. It is estimated that the work will cost about $2,000,000.

WOODLAND, CAL.—The Sacramento Valley El. Ry. Co. is reported to have sold its bonds in Europe, and the work of installing the projected electric lines on the west side of Sacramento will begin at once.

FAIRVIEW, MONT.—The county commissioners at Glendive are reported to have granted C. W. Jennison a franchise for an electric system at Fairview.

BOULDER, COL.—The Central Colorado Pwr. Co. is erecting about 30 new towers on its transmission line near Shoshone in order to reduce the length of some heavy spans.

TRINIDAD, COL.—The Trinidad El. Trans. Ry. & Gas Co. expects to construct within the next half year 60 miles of 44,000-volt high-tension transmission line, which will require 1800 kva in transformers to reduce the tension to 2300 volts. Geo. J. Gauthier, superintendent of construction.

## Canada

PORT MOODY, B. C.—The City Council has requested the Western Canada Pwr. Co. and the British Columbia El. Co. to submit bids for the installation of a street-lighting system in the district bounded by the two main thoroughfares as well as adjoining streets and avenues. The work of installing the system will be ordered by the Council shortly. The lighting of the South Shore district is also under contemplation.

## Miscellaneous

PORT ELIZABETH, SOUTH AFRICA.—The American Consul at Port Elizabeth reports that an electric lighting plant, to cost about $50,000, will be installed by the municipalty of Cradock, Cape Province, South Africa. Address B. A. Paterson, town clerk, Cradock, Cape Province, South Africa.

# New Incorporations

ALHAMBRA, ILL.—The Alhambra Mutual Tel. Co. has been incorporated with a capital stock of $2,500 to maintain and operate telephone lines. The incorporators are: C. Warber, Christ Rabberman, H. C. Henschen, F. W. Brumworth, August Abert, Patrick Farrell, Adolph Leuscher and J. D. Harris.

NORTH CHESTERVILLE, ME.—The North Chesterville Lt. & Pwr. Co. has been organized for the purpose of making, selling and supplying electricity, with a capital stock of $10,000. Officers: President, C. H. Pinkham; treasurer, L. S. Keith, both of Farmington, Me.

HICKORY, N. C.—The Wautauga El. Co. has been incorporated with capital stock of $50,000. Incorporators: N. S. Dasher, J. L. Riddle, H. C. Menzies, J. D. Elliott and others.

FORWARD, PA.—The Forward El. Co. has been granted a charter to operate in Forward Township, Butler County, and Pittsburgh, with a captal stock of $5,000.

HARRISBURG, PA.—The Jackson El. Co. has been granted a charter to operate in Jackson, Butler County, and Pittsburgh, with a capital stock of $5,000.

BIG WELLS, TEX.—The Big Wells Wtr., Lt. & Ice Co. has been incorporated with a capital stock of $10,000. Incorporators: Paul C. Levering, H. C. Ziegler and S. A. Armstrong.

# Directory of Electrical Associations, Societies, Etc.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, H. O. Hanson, Mobile, Ala.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Smithsonian Institute, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary-treasurer, Matthew R. Boylan, Public Service Railway Co., Newark, N. J. Annual convention, Atlantic City, N. J., Oct. 13-17.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, H. C. Donecker, 29 West 39th St., New York. Annual convention, Atlantic City, N. J., Oct. 13-17.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, H. C. Donecker, 29 West 39th St., New York. Annual convention, Atlantic City, N. J., Oct. 13-17.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary-treasurer, Eugene W. Stern, 103 Park Ave., New York City. The council meets the first Friday of every month.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Ernest Merritt, Cornell University, Ithaca, N. Y.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. W. Macon, 29 West 39th St., New York.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, 271 River St., Troy, N. Y.

ARKANSAS ASSOCIATION PUBLIC UTILITY OPERATORS. Secretary, W. J. Tharp, Little Rock, Ark.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Geo. C Holberton, Pacific Gas & Electric Co., San Francisco, Cal. Annual meeting, Cooperstown, N. Y., Sept. 8.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, James Farrington, Steubenville, Ohio.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago. Annual meeting, Chicago, Oct. 20-24.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, H. G. Martin, Toronto Electric Light Co., Ltd., Toronto, Can.

COLORADO ELECTRIC CLUB. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, Thomas F. Kennedy, 900 15th St., Denver, Col. Annual meeting, Denver, Oct. 6.

ELECTRIC CLUB OF CHICAGO. Secretary, W. M. Connelly, 1417 Monadnock Block, Chicago. Meet every Thursday noon at Hotel Sherman.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1613 Grand Ave., Kansas City, Mo. Annual meeting, St. Louis, July 12.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, Milwaukee, Wis.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago.

ELECTRICAL CREDIT ASSOCIATION OF PHILADELPHIA. Secretary-treasurer, John W. Crum, 1324 Land Title Building, Philadelphia, Pa. Executive committee meets second and fourth Thursday of each month.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. Secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

ELECTRICAL DEVELOPMENT ASSOCIATION, INC. Secretary, Zenas W. Carter, 53 State St., Boston, Mass.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Robinson, 124 West 42d Street, New York. Meeting, fourth Tuesday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA, NEW ENGLAND SECTION. Secretary, L. L. Edgar, 39 Boylston St., Boston.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York.

FLORIDA ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, H. C. Adams, West Palm Beach, Fla.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, J. D. Israel, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia, Chicago and Pittsburgh.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y. Meetings second and fourth Wednesdays, New Grand Hotel, New York.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary and treasurer, J. V. Zartman, 120 South Meridian St., Indianapolis, Ind.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th St., New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, E. J. Simon, 81 New St., New York. Meeting first Wednesday of each month.

INTERNATIONAL ASSOCIATION FOR TESTING MATERIALS. Secretary, H. J. F. Porter, 29 West 39th St., New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL COMBUSTION ENGINEERS' ASSOCIATION. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting, second Friday of each month at Lewis Institute.

INTERNATIONAL ELECTRICAL CONGRESS. Secretary, J. A. Barr, Exposition Building, San Francisco, Cal. San Francisco, 1915.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Next plenary meeting, Berlin, Sept. 2-6.

IOWA ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary, H. B. Maynard, Waterloo, Ia.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia.

JOVIAN ORDER. Jupiter (president), F. E. Watts, 239 West 39th St., New York; Mercury (secretary), E. C. Bennett, St. Louis, Mo.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary-treasurer, W. H. Fellows, Leavenworth, Kan.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. H. Bower Spangenberg, 625 Poydras St., New Orleans, La. Meets second Thursday of each month.

MAINE ELECTRIC ASSOCIATION. Secretary, Walter S. Wyman, Waterville, Maine.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATER WORKS ASSOCIATION. Secretary-treasurer, F. D. Beardslee, St. Louis, Mo.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Annual meeting, Chattanooga, Tenn., July 16.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, COMMERCIAL SECTION. Secretary, E. L. Callahan, 29 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, EASTERN NEW YORK SECTION. Secretary, R. E. Russell, Schenectady, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, GEORGIA SECTION. Secretary-treasurer, M. H. Hendle, Augusta, Ga. Annual meeting, Macon, Aug. 14-16.

NATIONAL ELECTRIC LIGHT ASSOCIATION, HYDROELECTRIC AND POWER TRANSMISSION SECTION. Secretary, L. H. Conklin, Scranton, Pa.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MICHIGAN SECTION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich. Annual meeting, Ottawa Beach, Aug. 19-21.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MISSISSIPPI SECTION. Secretary, F. J. Duffy, Natchez, Miss.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-treasurer, S. J. Bell, David City, Neb.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW ENGLAND SECTION. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NORTHWEST SECTION. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash. Annual meeting, Seattle, Wash., Sept. 10-12.

Electrical World

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, Ralph Sweetland, 141 Milk Street, Boston, Mass.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, Richard Valentine, Janesville, Wis.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

NEW YORK ELECTRICAL CREDIT ASSOCIATION (affiliated with the National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of directors meets second Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

NEW YORK ELECTRIC RAILWAY ASSOCIATION. Secretary, Charles C. Dietz, United Traction Co., Albany, N. Y.

NORTHWESTERN CEDARMEN'S ASSOCIATION. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Cedar Point, July 15-17.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. E. Kilkenny, St. John's, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.). Secretary-treasurer, Walter E. Long, 1000 Chestnut St., Philadelphia, Pa.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. E. Rosenberg, Bethlehem, Pa

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. Secretary-treasurer, Philip S. Dodd, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. H. H. Norris, Ithaca, N. Y.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Manchester, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meeting, fourth Monday of each month, except January, July and August.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, Stephenson Building, Milwaukee, Wis.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 24, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York]

1,065,344. TOY CONSTRUCTION; J. L. Cowen, New York, N. Y. App. filed April 22, 1912. Electric automobile taking current from conductors disposed in a roadway.

1,065,361. ELECTRODE BOX; H. B. Hartman, Philadelphia, Pa. App. filed Aug. 11, 1911. For purification of water and other electrolytic operations.

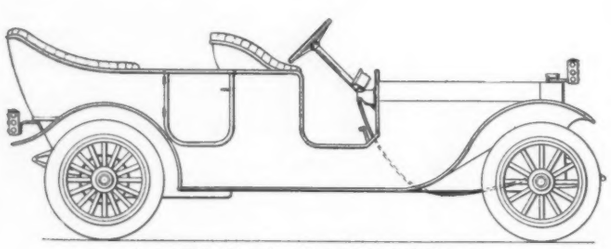
1,065,362. FLOW-RESPONSIVE CIRCUIT CONTROLLER; H. B. Hartman, Philadelphia, Pa. App. filed Aug. 11, 1911. For use in connection with apparatus for the electrical purification of water.

1,065,363. REVERSING-SWITCH MECHANISM; H. B. Hartman, Philadelphia, Pa. App. filed Aug. 11, 1911. To periodically reverse polarity of electrodes in electrolytic water purification plant.

1,065,380. ELECTRODE CONTACT CLAMP; J. G. Marshall, Niagara Falls, N. Y. App. filed Jan. 8, 1913. Power-actuated electrode clamps for electric furnaces.

1,065,388. PANELBOARD SUPPORT FOR OUTLET BOXES; W. F. O'Neill, Wilkinsburg, Pa. App. filed June 28, 1912. Eccentrics for varying position of panelboard within the outlet box.

1,065,426. ELECTRIC HEATER; H. W. Beers, Guadalajara, Mexico. App. filed Aug. 22, 1912. Portable; body of refractory material which incloses the resistance heating unit.



No. 1,065,672.—Auxiliary Visual Indicator

1,065,434. CIGAR LIGHTER; C. S. Drake, Milwaukee, Wis. App. filed July 20, 1912. Wick electrically ignited and automatically extinguished.

1,605,465. ELECTRIC HEATER; J. Nathan, Coutolenc., Cal. App. filed Oct. 2, 1912. For heating fluids in steam tables, percolators, etc.

1,065,478. REPEATING TRANSMITTER FOR FIRE-ALARM TELEGRAPH SYSTEMS; N. H. Suren, Needham, Mass. App. filed July 22, 1910. Actuating means for the circuit-operating device is operated by either one of two independent operating devices.

1,065,492. JOINT FOR ELECTRICAL CONDUITS; C. W. Abbott, Auburn, N. Y. App. filed April 14, 1911. Conduit section is clamped to the conduit member by a screw.

1,065,532. DYNAMO-ELECTRIC MACHINE; E. R. Knight, Norwood, Ohio. App. filed June 7, 1909. Squirrel-cage rotor in which the ends of the conductors are bent over into contact with each other, thereby to form an end ring.

1,065,550. ELECTRIC SWITCH; E. H. Rieken, Chicago, Ill. App. filed Jan. 2, 1913. Double-throw type for induction motors; cannot be thrown directly into running position without first being brought to starting position and cannot be left at starting without being held there.

1,065,570. TELEPHONE-RECEIVER SUPPORT; C. D. Wightman, Glenwood Springs, Col. App. filed March 17, 1912. Receiver mounted on pivoted arm which is carried to circuit-closing position by engagement of the ear with the receiver.

1,065,605. PROCESS OF REMOVING SULPHUR AND PHOSPHORUS FROM IRON AND SIMILAR METALS; A. E. Greene, Chicago, Ill. App. filed Nov. 6, 1911. Produces vapor of lime by subjecting lime to electric heat and then introduces said vapor into body of metal under treatment.

1,065,628. SIGNAL-SENDING DEVICE; H. O. Rugh, Sandwich, Ill. App. filed May 4, 1909. For use at central station to call number of stations connected to the same line wires and which are of the step-by-step or impulse type.

1,065,649. PNEUMATIC GOVERNOR; B. S. Aikman, Chicago, Ill. App. filed Jan. 11, 1910. For compressors; primary pressure chamber with high-pressure and low-pressure valves controlling connection between the pressure chamber and the piston chamber and atmosphere.

1,065,653. MUNICIPAL LIGHTING AND POLICE - SIGNALING SYSTEM; J. P. Barrett, Chicago, Ill. App. filed July 12, 1911. Street lamps utilized to signal the police.

1,065,657. ELECTRIC CONTROLLER; A. E. Berdon, Lafayette, Ind. App. filed Jan. 6, 1911. For charging storage batteries on automobiles and car-lighting systems.

1,065,672. AUXILIARY VISUAL INDICATOR; H. R. Elliott, Columbus, Ohio. App. filed Jan. 22, 1912. Speedometer controls circuit through signal lamps which give indication to pedestrians, etc., of speed of vehicle.

1,065,683. ANNUNCIATOR; H. J. Heeney, Boston, Mass. App. filed Oct. 12, 1910. For releasing a target or bank of targets.

1,065,690. REGULATING AND REVERSING APPARATUS FOR REGENERATIVE GAS FURNACES; H. Kopper, Mülhein-on-the-Ruhr, Germany. App. filed Aug. 19, 1912.

1,065,692. TROLLEY WHEEL; J. Kress, New Rochelle, N. Y. App. filed May 20, 1911. Spring-tension knuckle joint between trolley harp and pole.

1,065,704. FILM-COATED METALLIC ARTICLE AND METHOD OF MAKING THE SAME; R. D. Mershon, New York, N. Y. App. filed Dec. 21, 1911. Article is subjected to a boiling bath of the film-producing agent and an electric current is passed through the article and the bath.

1,065,722. TRAIN CONTROL; F. M. Raymond, Saugatuck, Conn. App. filed March 21, 1913. Trolley is diverted from the main line to a branch conductor of different (preferably zero) potential.

1,065,737. INSULATOR AND SUPPORT; A. J. Slonecker, Trenton, N. J. App. filed July 31, 1912. Has a spiral live-wire-receiving groove and rotates to permit of slackening or tightening of the live wire during the swinging of the wires.

1,065,760. MEANS FOR SWITCHING BOOSTER TRANSFORMERS; W. Zederbohm, Charlottenburg, Germany. App. filed Oct. 19, 1911. For readily and safely disconnecting and connecting the booster transformers from and to the system.

1,065,771. TROLLEY; M. A. Born, Oconomowoc, Wis. App. filed Oct. 7, 1911. Restoring wheels on opposite sides of trolley wheel with spring-pressed contact elements between the restoring wheels and trolley wheel.

7,065,804. GONG-ACTUATING MECHANISM FOR ELECTRIC CARS; R. A. Heffley, Denver, Col. App. filed June 24, 1912. Gong-actuating switch on controller handle.

1,065,805. TELEPHONE ATTACHMENT; S. J. Heimbuecher, Jr., Pittsburgh, Pa. App. filed June 29, 1912. Receiver supported by extensible lazy-tongs structure which is attached to the ordinary receiver hook.

1,065,851. TROLLEY REPLACER; G. A. Spaeth, Columbus, Ohio. App. filed March 14, 1913. Has a relatively fixed insulated replacer roller and a slidably mounted trolley wheel which may be withdrawn below the plane of the replacer roller.

1,065,861. BURGLAR ALARM; G. A. Brewster, New York, N. Y. App. filed May 17, 1911. Circuit-closing pendulum suspended from doorknob.

1,065,884. SIGNAL DEVICE; C. F. Marston, New York, N. Y. App. filed May 26, 1911. For automobiles; to notify following vehicles of proposed movements.

1,065,886. PROCESS OF PRODUCING RADIATOR SECTIONS; I. A. Randel, Chicago, Ill. App. filed Jan. 24, 1912. Copper shell is electrodeposited on lead strip which has been formed to desired shape and lead is then melted out of the seamless shell so formed.